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A Monthly Popular Journal of Knowledge

July 1937

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(Continued on page lxi)



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DISCOVERY

A Monthly Popular Journal of Knowledge

Vol. XVIII. No. 211. JULY, 1937.

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Editor : L. RUSSELL MUIRHEAD, M.A.

Publishers : BENN BROTHERS, LTD. All communications respecting editorial matters to be addressed to the Editor ; all questions of advertisements and subscriptions to the Manager.

Offices : Bouverie House, Fleet Street, London, E.C.4. (Closed on Saturday.)

Telephone Central 3212. Telegrams : Benbrolish, Fleet, London.

Annual Subscriptions 12s. 6d. post free anywhere in the world. Single numbers 1s. net ; single back numbers more than two years old, 1s. 6d. net ; postage (inland and foreign) 2d. Binding cases, 2s. 6d. net each ; postage 6d.

Notes of the Month

NOTORIOUSLY modest in calling attention to its merits, even to its existence, the scientific Press can at least claim the credit of unrestricted international circulation. While more widely circulating news-sheets are blackguarding their foreign neighbours (rightly or wrongly), with the inevitable effect of official censorship, confiscation, or temporary prohibition, the scientific journals continue to circulate all over the civilised, and much of the uncivilised, world. In these days, when the exploitation of national jealousies has too great a "news-value," workers in the advancement of knowledge have continued to record their discoveries with a truly international spirit. The numerous polyglot scientific periodicals are a sufficient proof of this, which is confirmed by the editorial post-bag of any journal of the nature of DISCOVERY. The future of civilisation, in more senses than one, may well be in the hands of the scientific workers of the world.

* * * *

Bearing in mind, no doubt, the influx of visitors that this auspicious year is likely to attract to London, H.M. Stationery Office have been well advised to publish, at the price of sixpence, a new edition of the *Brief Guide to the National Museums and Galleries of London*, which was first issued in 1935. The new edition shows a considerable improvement on the original : the Imperial War Museum, now in its new home, can be adequately

dealt with ; the National Maritime Museum makes an attractive addition ; and the illustrations are more numerous and even better than in the first edition. Some amusing anachronisms remain in the street-plans, however, some of which might mislead the unwary stranger.

* * * *

From Lancaster House, St. James's, comes an admirable and beautifully executed album entitled *Twenty-Five Years of the London Museum*, price 2s. 6d. This contains a short account of the history and objects of the London Museum, and no less than 130 fine photogravure plates of exhibits in the Museum, from a couple of mesolithic bone harpoon-heads to the "peacock" dress worn by Lady Curzon at the Delhi Durbar. Londoners are never tired of smugly admitting their ignorance of London, and their confessed lack of knowledge of the London Museum is sometimes almost triumphant, even taxi-drivers having been found unaware of its location. A benevolent dictator would insist on the presence of this album in every London home ; our milder democracy should at all events see that it finds a prominent place in every public library in the metropolitan area.

* * * *

The second annual Conference of the British Speleological Association, of which Sir Arthur Keith is President, will meet at Bristol on July 23rd-26th. Through the hospitality of the University authorities the meeting-place of the Conference will be in the Great Hall of the University, where also there will be an exhibition with contributions from nearly all the important caves in the world, including some unique illuminated transparent photographs. While the Conference is in session members will have access to the museum of the Bristol University Speleological Society, which has done some remarkable work in bringing to light evidence of cave man in the Mendips, as well as in South Ireland. The Conference will meet in two sections, one devoted to cave excavation and matters of archaeological interest,

the other dealing with potholes, cave exploration and surveys, and the hydrology, palaeontology and geology of caves.

* * * *

Among a large number of distinguished archaeologists and cave explorers who have promised to take part in the proceedings are Dr. Dorothy Garrod, Professor L. S. Palmer, Dr. R. R. Marett, and Dr. F. E. Zeuner. A free illustrated lecture, on some aspects of the French and Spanish caves, will be delivered by the Abbé Breuil. Another lecture will give an account of some of the caves of Central Europe. This will be delivered by Mr. C. R. Hewer and is preparatory to an excursion to a selection of the most important and interesting caves of Germany, Czechoslovakia and Austria, from July 27th to August 7th, for which the arrangements have been made by him. The opportunity is unique as the public is not admitted to several of these caves. The party will first visit Nürnberg, from which centre they will proceed to the caves of Pottenstein, archaeologically and palaeontologically important, and inspect a mesolithic cave shelter which has been specially excavated for their visit. Thence they will proceed to Brno, in Czechoslovakia, where they will have an opportunity of seeing the collections and visiting the sites of the remarkable mammoth-hunters' culture of Moravia, with its unique assemblage of objects of palaeolithic art. Here they will be conducted by Professor C. Absolon, who has been in charge of cave exploration in Moravia since 1927.

* * * *

An expedition under the auspices of the Soviet Government to Central Asia, of which some of the results have been published recently, was fortunate in discovering evidence of Bronze Age gold mines in Kazakhstan. Narrow shafts from 20 to 25 metres in depth had been sunk, which were connected by galleries underground 100 to 150 metres long. The number of tools found, mostly of stone, though some were of bronze, suggests that a very large number of workmen had been employed. Two skeletons of workmen who had been overwhelmed by a fall of the roof were found. On one of them was a necklace of beads and in one hand was a stone hammer and in the other a chisel of bronze. Neither skeleton was Mongolian in character, and no traces of iron were found. Near the mines were primitive ore-crushing plants in the form of stone slabs and hammers. A number of shallow bowls have been found, which probably served as lamps with fat for illuminant. The site will be further explored, as the Government is sending out an expedition to work the gold, which still exists in the mines.

The remarkably primitive character of the Swanscombe skull has been discussed recently in DISCOVERY (Oct., 1936), though some reserve has been shown as to the inferences to be drawn from it. French anthropologists, in particular, have shown no little caution in accepting the find at its apparent face value and in the current number of *L'Anthropologie* doubt has been expressed as to whether something of the primitive character claimed for it may not be due to a posthumous modification of its form by pressure of the earth on it. As it is desirable that all question of error or misinterpretation of evidence should be removed with as little delay as possible, a committee of investigation has been appointed under the aegis of the Royal Anthropological Institute, which will examine the evidence and co-operate with Mr. A. T. Marston, the discoverer of the skull, in the further excavation of the site. The Chairman of the Committee is Mr. M. A. C. Hinton, F.R.S., Keeper of Zoology, British Museum. Mr. K. P. Oakley, of the Department of Geology, British Museum, will act as Secretary. Among the members of the Committee are Professor P. G. H. Boswell, Professor W. E. Le Gros, Clark, Dr. G. M. Morant and Mr. S. Hazzledine Warren.

* * * *

On the occasion of the Annual Inspection of the National Physical Laboratory by the General Board on June 22nd, some 2,000 scientists from all parts of Great Britain met at Teddington to review the work of the Laboratory and the advances made during the year. Space permits us here to refer only to a few of the exhibits of most general interest. These include, in the Physics Department, a new portable apparatus for the measurement of noise. The meter shown is of the objective type, in which a numerical value of loudness is given by the movement of a pointer over a dial. The circuits have been so designed as to take due account of the case where the sound under study is intermittent. The meter has been used to a considerable extent in the study of the noise from motor vehicles, and the results were adopted by a Ministry of Transport Committee in a recommendation for a maximum noise level for newly manufactured vehicles. In the Engineering Department, the study of the fatigue of metals under corrosive conditions has thrown much light on the causes of many failures which were previously unexplainable. The researches carried out have shown that the fatigue resistance of some metals is considerably reduced even by contact with the atmosphere. The Metallurgy Department has investigated the problems of oxygen in steel and the permeability of wood by gases; and in the Aerodynamics Department important discoveries are being made regarding the stability of aeroplanes.

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SIBERIA awakes to

By Kurt Lubinski.

The story of a journey through the backward parts of Siberia, illustrated with the author's own photographs, which tells how modern civilisation has impinged upon tribes among whom progress has been at a standstill for hundreds of years.

A THIRTEEN-thousand-mile journey is behind me. By aeroplane to Leningrad, then by Far East express across to Asia, onward in the hard, wooden compartments of the snail-like Siberian local trains, and finally in the native *troika* and on horseback across steppe and mountain. What I saw was Siberia awakening, a land groping for new paths to the future after centuries of total apathy and years of war and revolution. We foreigners coming into the country take many things for granted—such as public parks and 'buses—which, to the inhabitants, appear startling innovations. The desolation of the scenery and the poverty of the people contrast strikingly with the cheerful aspect of a European village and the disciplined, up-to-date beauty of an American town. The contrast is stressed where concrete buildings jostle wooden huts.

The belief in Siberia's future arose before our days. Every generation has focused its gaze on distant lands. The paternal care for its descendants, the fear that the earth would not always afford them sufficient space and food, was the motive. Almost simultaneously with the



A Shaman priestess of the Shakass tribe dancing in an ecstasy.

recognition of the fact that America could dispense with its hitherto innumerable immigrants, Siberia began to attract the attention of the world. The Tsar's



A member of the Oirot parliament listening-in.

decree had promised that no exiling of serious criminals should discredit the country of the future any longer. There was, up to that time, only one conception of Siberia; the feeling awakened by the mere name was one of bleakness; no word was heard of the beauty of the Altai Mountains, or of the idyllic loveliness of the country's woodlands. Imagination conjured up long processions of chained exiles toiling drearily at the building of endless roads, and the picture was sketched in with many unpleasant details: the black ignorance of the Siberian peasants, living far from any school; the vodka which merchants used rather than cash to pay for the goods they bought in the country.

In 1913 the great Norwegian explorer, Fridtjof Nansen, sailed along the north coast of Europe and Asia, across the Kara Sea, and down the Yenesei into the heart of Siberia, and he was able to confirm the promising report that a new way into the country had been opened up. Since then ships of the so-called "Karian Expedition" have sailed yearly along the same course, taking merchandise, returning with timber. For Siberia, wakened from its lethargy, needs foreign goods. At the same time the natural international need for many of Siberia's own products has made itself felt; timber, precious metals, minerals, and foodstuffs were wanted. Along the railway on the banks of the Ob, between Barnaul and Biisk, great dairies on the Danish plan sprang up. An envious feeling often possessed me when I saw the butter rolling towards

the west in snow-white, fresh-looking refrigerator trucks, while I, in an almost airtight, slow-moving local train, trying all the time to keep the wooden bench free from dust, crawled eastwards huddled together with half a hundred fellow-passengers. Several times a day the guard came in, swept the floor with a birch-broom, and sprinkled it with water from an old mineral-water bottle. It was of precious little use, but it proved his goodwill.

The Turksib railway from Siberia into Turkestan starts in the Kirghiz republic of Kazakstan. There is much that is remarkable in this region. In the town cars thread their way past long strings of slowly-moving camels; on the steppes live nomads who have troubled little about Allah and even less about any government. The men, with their long, flowing beards, their slanted eyes giving their faces a grim appearance, wearing padded cloaks and huge riding boots with the toes curving up, still look like the old Huns. Actually, however, they are the personification of hospitality and

Kirghiz out on the steppes, and now our little cart, a creaking basket mounted on wheels and bouncing its occupants from side to side, jolted out of the town. Twice we had to take the ferry over the Irtish. Twice riders, camels, and oxen crowded down to the banks in a straggling line. The ferries were floating villages. Within a couple of minutes we were told the market price of calves and chicken and the distant place of origin of each individual camel waggon. But from the other bank the caravan tracks spread wide apart. The steppes and their loneliness began.

We made first for the winter quarters of the Kirghiz. The driver knew the way and let his equipage trot. Mud huts suddenly appeared among the apparently uninhabited hills. From one of them, after much shouting on our part, a little old man appeared, but we could not understand each other. On the one hand, even our driver himself could not comprehend the Kirghizi that stumbled from the old man's toothless mouth, while on the other the old man himself was almost stone deaf.

At last one of us bawled into his ear the magic word "kumys" (mare's milk)! The old man understood. He tottered unsteadily to a hillock and pointed southwards into the steppe. We went on. Gradually, signs of life began to appear. Peculiar star-shaped shifting groups, which we had noticed from high up, resolved themselves into herds of horses. With the sun tormenting them, the animals were standing in rough circles with their heads to the middle and their tails flicking away the flies.

We got down right in front of the round birch huts. Kirghiz came stooping out and gave us their hands. While the children clambered inquisitively over our cart we were invited in. The tent, or hut, with its frame of birch twigs matted

across with rushes and covered with felt, is the summer home of the nomads, and at the same time the very primitive headquarters of the mares' milk industry. Marvellous cures of anaemia and tuberculosis are attributed to mare's milk in Siberia. Before it is drunk the milk is allowed to ferment and acquires a germicidal power like that of alcohol. Many people trace its great nutritive value to the fact that the mares are milked for only six months in each year. Everywhere, in the taverns on the caravan routes, in restaurants in town,



A meadow for sacrifices in the Altai Mountains, with an altar made of branches, and a newly-sacrificed horse.

goodwill. Without thought of their own profit they have handed over their small pieces of land to be farmed by the poor Russian immigrants. The Kirghiz were oppressed in many ways under the Tsars; to-day they are known as Kazaks, their own name for themselves having been officially adopted.

One morning at half-past five we left the Kirghiz "Town of the Seven Great Tents," known in our atlases by its untranslated name of Semipalatinsk. We had inquired there where we could meet nomadic



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Two pictures from a propaganda placard of the Soviet urging the natives to give up the Shaman cult, saying, "There are no gods! No sacrifice of horses will deliver you from your need." The contrast in the amenities among the old superstitious Oirots and the modern sovietised citizens is instructive.

on railway stations, even during the interval at the theatres, mare's milk is sold.

In a corner of the Kirghiz tent stood the great pitcher full of the milk. It takes the place of both beer and wine, and anyone not accustomed to it does well to take it in moderation. Luckily we were able to repay the liberality the Kirghiz showed in this matter of milk. Men and women sat together in the tent and they ate the sweets we had brought with an ease of manner which left no doubt of the equal footing of the two sexes. Before we had come to Kazakstan we had been told: "You won't see much of the Kirghiz women—the men hide their wives from strangers." Our experience was exactly the opposite. The women gazed at our cameras full of curiosity. Not one of them ran away when we were taking photographs and none of the men attempted to restrain them.

From the Kirghiz steppe we travelled south-east to the Altai Mountains, where Siberia and Mongolia meet. Our goal was Ulala, capital of the Oirot self-governing district, a town so small that one can walk right through it in a quarter of an hour. The Oirots are the original Turks who have merely borrowed all kinds of customs from their Mongolian neighbours and so for a long time were believed to be Mongolians themselves. The men wear pigtails and long coats buttoned down the side from the armpits. Present-day official historiography in Turkey traces the descent of the Turks directly back to these dwellers in the Altai Mountains. When we arrived, delegates from the surrounding mountain districts had just met for a conference in Ulala. They were to get acquainted with the general economic principles of the Soviet system. There sat these strange figures, their fur caps turned up above their black pigtails, looking out of place on the unaccustomed wooden seats. When business was being transacted in their language the Russians, bored, left the chamber, and when a Russian speaker rose the Oirots trooped out

into the open air, drew their long Mongolian pipes out from their fur boots, and smoked.

Young girls, slit-eyed, but wearing European coats, blouses, and knee-boots, are the new generation. Their own mothers were bought, stolen, or given in their childhood by one tribe to another. The only point in which women had equal rights with men was in their being allowed to smoke. All the wizened and wrinkled old women we met in the mountains puffed away at some abominable tobacco. In the Co-operative Restaurant in Ulala sat the young girls smoking their cigarettes, a sign of the new times. Here, in the Siberian-Mongolian frontier mountains, we were able to see how the teaching of the Shaman, the native priest, is now being put down by the Soviet. Shamanism is the primitive Asiatic Animism, stretching back farther than Islam, farther even than Buddhism, into dimly-lit ages in the history of man. With its medicine-men and its ritual of horse-sacrifice, Shamanism stands in the way of all enlightenment. One therefore meets here large groups of people who present a problem altogether new in the history of colonisation: for the Soviet State, which wishes to exterminate the spirit-worshipper, is at odds with all beliefs, sending into these parts instead of missionaries only teachers and doctors. They have a heavy task to convert idol-worshippers by means of their rationalism into materialistic infidels.

In the mountain villages we had to give up our cart and take to horseback. Hence the following tale, peculiar to these parts. Each of us rode a mare and each of our mounts had its foal, which ran skipping and tripping behind the mother along the mountain paths. It happened more than once that the young ones were lost behind the bushes. They whinnied from the distance, the mares, nostrils wide, answered, and in a moment our small caravan was thrown into disorder. Once, when I tugged the bridle, the mare having stopped for an instant, the foal, without loss of time, slipped

underneath her and began to drink greedily. Neither the foal nor its mother allowed itself to be put out by the rider in the saddle. The Oirot villages lie hidden among the mountain slopes. Our road suddenly ended. In front of us, reaching up to the sky, stood three gallows-like posts. On their points hung bare, shining white horses' skulls. Behind them, as if on a giant clothes-hanger, hung three complete horses' skins, the lifeless hoofs clapping together in the wind. We had come to one of the altars of the Oirots. Here sacrifices are offered up at full moon. The halter, made from each horse's own mane, as the teaching prescribes, is wound about the neck and grimly tightened. Here, indeed, is the tribal age of Asia, ten hours' journey from the capital where schoolchildren learn that neither God nor the gods exist.

South of Tomsk to the Yenesei River stretches the territory of the Shakass. Here, too, two ages can be seen in living contrast. On the way we were told of a village where there was a Shakass with a wife who, as a Shaman priestess, was recognised as having communion with the spirits. Among the primitive peoples of Siberia her former enslavement did not prevent the woman from becoming a priestess. We soon found the village referred to. The husband of the priestess shook his head doubtfully when he heard that we wished to see his wife. For one thing, there were the laws of the tribe, but then—equally weighty—the provision of the Soviet State, which, in raising the woman to equal rights of citizenship with the man had also put an end to her position as village sorceress.

The Dance of the Priestess

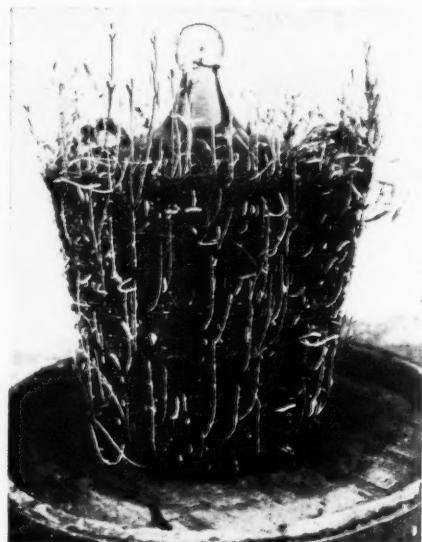
Finally, after hours of discussion, his wife appeared, a powerfully-built peasant woman with bold, handsome features. She was dressed exactly like a male Shaman priest, with tinkling bells and wings on her shoulders. She carried the exorcising drum with the carved picture of the gods. For her dance she covered her face with a mask hung with black and red ribbons which stretched from forehead to breast. The priestess hid her womanhood: the status of Shaman priest is above sex. And yet one could recognise the woman, when she began to circle in the dance, by her heavy black locks, until, as she whirled quickly and more quickly, the flying ribbons and feathers and spangles broke up all contours and nothing remained but the gyrating symbol of an ever-fanatical Asia.

But the new age made its entrance at last, sobering, full of realities, crowding out Asiatic romance. In the Siberian towns from Omsk to Vladivostok we saw the same goods everywhere. Everyone had a claim to the regulation length of cloth and to one of the five thousand

linen caps, samples of which decorated the shop windows. In Minussinsk we had got to know a young Shakass girl, whom we often accompanied on shopping expeditions to the market. Here the new Russia recommends itself to its children rather through the medium of bath-tubs, scrubbing-boards, and fire-tongs than through its many decrees. Our Shakass had been to school and knew what was right and proper. We had promised her a treat at leave-taking. She made up her mind what she wanted and took us to the market to a stall where green celluloid bangles and ornamental combs, Europe's latest product, were lying. She found the choice between bangle and comb so difficult that we gave her both. She put them on on the spot, with the silent joy of the Oriental, and promised never to forget us.

A Budding Willow-basket

On a farm at Wittenberg, near Halle, in Germany, a budding willow-basket has been found in one of the store-rooms. The basket forms the wrapping of a big, round bottle of spirit which was completely corked up. It was ascertained, by means of a thorough investigation, that the basket was stationed on a dry spot, that it was



not exposed to a more than usual extent to the sun and that the liquid itself could not possibly have had any influence on its state.

Despite these facts it was noticed that, during the spring, more and more of the basket became green and finally it started budding. In fact it seemed to possess almost inexhaustible vitality, for though not connected in any way with the soil it was still able, like a living tree, to produce new leaves.

Stereochemistry—II.

By Peter Maitland, B.Sc., Ph.D.

Dr. Maitland presents a continuation of his first article on Stereochemistry, which appeared in the November, 1936, issue of DISCOVERY. The position in space of the atoms composing more complex molecules is considered, in connection with their possible optical activity, together with the fascinating problem of the origin of optically active compounds in nature, and the striking differences in the physiological activity of some enantiomers are shown.

In the previous article (November, 1936) the arrangement in space (or Stereochemistry) of the atoms in a compound of carbon was considered, and it was shown that the four atoms or four groups of atoms around the central carbon atom must be arranged at equal distances and angles in three-dimensional space, that is, at the four corners of an imaginary regular tetrahedron. It was also shown that this theory accounted completely for the observed optical properties of substances containing one or more *asymmetric* carbon atoms, the substance with one asymmetric carbon atom being capable of existing in three forms, the *dextro*-, the *levo*-, and the optically inactive or *racemic* form, and the substance with n asymmetric carbon atoms being capable of existing in 2^n optically active forms and $\frac{1}{2} 2^n$ inactive forms. All these types of substances, however, when made in the laboratory, are always

with the formation of a ring or rings. It has been computed that over one million compounds of carbon are known at the present time, and thousands of new carbon compounds are made every year. In Fig. 1 are shown a few skeleton structures of some of the simplest of such compounds: (a) five-membered straight chain compound, (b) five-membered branched chain compound, (c) three-membered ring compound, (d) six-membered ring compound.

As we saw in the first article, the carbon atom has a "valency" of four, that is, it has always four bonds to dispose of, and these have been shown to be radiating tetrahedrally in space. The actual appearance of the five-membered straight chain compound in Fig. 1 (a), with hydrogen atoms attached to all the free bonds has already been shown in the previous article (Fig. 10). Let us now consider a substance with three carbon atoms in a ring of the type Fig. 1 (c).

With the consideration of this type of carbon ring compound about to be described, we leave the substances containing a simple asymmetric carbon atom, which has four different atoms or groups of atoms attached to it, for the type of compound containing several carbon atoms in the molecule, where it is sometimes difficult to say whether or not the molecule contains an asymmetric carbon atom in the strict sense. Such compounds are, therefore, considered from the point of view of the molecule as a whole, the question as to whether it is non-resolvable or resolvable depending on whether the molecule itself is symmetric (has a plane of symmetry) or asymmetric (has no plane of symmetry), respectively.

If we consider now a substance of the type, Fig. 1 (c), it will be seen from the skeleton diagram that each carbon atom has two bonds left over. Let us add to these six vacant places 4 hydrogen atoms and 2 other atoms, which we shall signify as X. If we consider only the forms of the compound in which the two atoms X are on different carbon atoms, it will be seen from Fig. 2 that there are two ways, and only two, of arranging the six atoms. Owing to the tetrahedral arrangement of the carbon bonds, when three atoms are linked together as in the diagram, two of the bonds from each atom unite to form an equilateral triangle, which we can

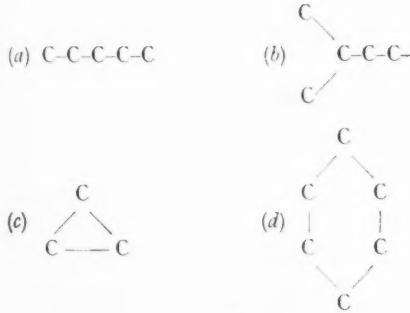


FIG. 1.

produced in their optically inactive form, and methods were described for "resolving" them into the optically active *dextro* and *levo* forms (sometimes called *enantiomers*). Finally, attention was directed to the wonderful new weapon used in attacking stereochemical problems, the X-ray photograph.

Let us now consider the appearance of the molecules of several other carbon compounds. The element carbon is unique in its property of being able to combine with itself to give rise to an enormous number of substances in the molecules of which the carbon atoms are linked together in the form of long chains, or in which some or all of the chains have closed round on themselves

assume to be situated at right angles to the plane of this paper, and the four hydrogen atoms and the two X atoms will then be *in* the plane of the paper. When the two atoms X are on the same side of the triangle, we get what is called the *Cis*-form of the compound (Fig. 2a), and when the two atoms X are on opposite sides to one another, one above, the other below the triangle, we get the *Trans*-form. Examination of the *Cis*-form shows that it possesses a *plane of symmetry*, a plane at right angles to the carbon triangle, and cutting the molecule through the centre carbon atom in the diagram and its two hydrogen atoms, and bisecting the side of the triangle between the other two carbon atoms. Such a molecule, possessing a plane of symmetry, is completely superposable upon its mirror image and should, therefore, exist in only one form. On the other hand, the *Trans*-form has no plane of symmetry and is, therefore, non-superposable upon its mirror image and should, consequently, be resolvable into *dextro* and *laevo* forms.

Many such derivatives of the above type have been

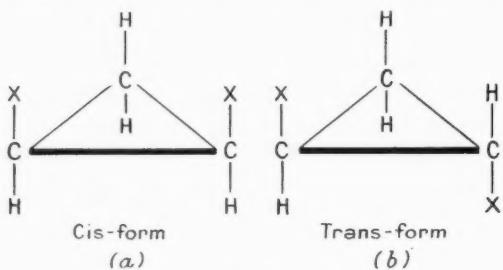


FIG. 2.

From John Read's Text Book of Organic Chemistry, by permission of G. Bell and Sons, Ltd.

examined and in nearly all the cases they have been found to exist in two forms, one non-resolvable and, therefore, the *Cis*-form, the other resolvable and, therefore, the *Trans*-form. In the exceptional cases where only one form has been isolated, this is almost certainly because the *Cis*-form is unstable and readily passes over into the *Trans*-form, which is always the more stable of the two forms, because the weight of the constituent atoms is more uniformly distributed on both sides of the ring.

The example now to be considered illustrates a new type of optically active molecule which was known for several years before an explanation of its activity was forthcoming. The substance is a derivative of the hydrocarbon diphenyl $C_{12}H_{10}$, which consists of two rings, each of six carbon atoms and five hydrogen atoms, joined together between two of the carbon atoms. The formula for diphenyl, written out fully, appears in Fig. 3a. It will be seen that each carbon atom in the

rings has one hydrogen atom attached to it, with the exception of the two carbon atoms connecting the rings together. This leaves several of the valencies or bonds of the carbon atoms to be accounted for, since each atom has to have four bonds. This is achieved by making the links between each carbon atom alternately single and double. The existence of "double" and even "triple" bonds in Chemistry opens up wide fields in Stereochemistry, but it will be sufficient for our purpose at the moment to say that it has the effect in this case of making the carbon atoms in *each* ring planar with respect to the other atoms in their own ring; but the two rings, which are joined by a single bond, are free to rotate on the axis of this single bond, and the position of the plane of one ring relative to the plane of the other is never fixed, and in all probability they are both spinning continuously. Now remove the three hydrogen atoms indicated and substitute them by the groups A, B and C. Fig. 3b shows the appearance of the molecule now, the individual atoms being drawn as spheres of approximately the relative size to each other as deduced from X-ray measurements. It will be seen that the group C (the dark sphere) cannot get past the groups A or B when the rings are rotated. It knocks against these groups and, therefore, the relative movement of the rings is now restricted. Suppose that the molecule of this substance is made from a molecule of the simpler substance containing the ring with the groups A and B attached to it, by combination with a molecule of the substance containing the ring with the group C. Then, at the moment of formation, there is an equal chance that the resulting molecule in Fig. 3b will be composed of molecules, where in the one case the group C lies on one side of the planar ring containing the groups A and B (Fig. 3c), and in the other case where it lies on the other side. (Fig. 3d.) This figure is obtained by taking the Fig. 3c, changing the group C from the top to the bottom of the ring, and then turning the resulting figure through an angle of 180° in order to show the relationship between the two.) It will be seen from Fig. 3c and 3d that these two molecules are related to one another as right and left hands, that is, as non-superposable mirror images, and the substance should, therefore, be resolvable. (In Figs. 3c and 3d the ring containing C is shown in the middle position of its vibration, for simplicity.) Many derivatives of the hydrocarbon diphenyl, with different groups replacing A, B and C, have now been made and in all cases where the groups are big enough to collide, resolution into optically active forms has been achieved.

Turning now to the consideration of the fascinating problem of how optically active forms are produced by Nature, while even with all our modern advancements

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we cannot do this in the laboratory without the use of an asymmetric agent (usually obtained from Nature), we can say quite definitely that no satisfactory explanation exists. Some have suggested that the explanation lies in the fact that the rotation of the earth on its own axis is always in one direction relative to the sun. To take an analogy from the plant world, this may be the explanation of the fact that most climbing plants are dextral, that is, they climb in a right-handed spiral. An exception to this rule, however, is found in the hop, which is sinistral.

Others have suggested that the origin of naturally occurring optically active substances is to be found in the asymmetric influence of a certain form of light called circularly polarised light, which is obtained by reflection of the sun's rays from the surface of the sea, and which can exist in two forms, right-handed and left-handed. In order to understand the meaning of these terms let us assume that ordinary light is composed of solid particles, which move at a very great speed in a straight line, at the same time vibrating in all directions about the straight line. In circularly polarised light, however, the vibration is limited, in such a way that the resulting motion of the particles is in the form of a spiral, which may be right-handed or left-handed, either form being obtained easily, when produced artificially in the laboratory, by a simple adjustment of the necessary apparatus.

In support of this theory that the production of such light from the sun is the cause of the occurrence of optically active substances in nature, we have the very interesting experiments recently performed in the laboratory in which optically active substances were produced from their inactive forms by means of artificial circularly polarised light. A beam of light from an artificial source is divided into two beams of circularly polarised light, one right-handed and the other left-handed. The right-handed beam is passed through a solution of the optically inactive form of the special substance under examination, and the other beam is allowed to pass through a separate but identical solution. Under the influence of the light the substance (which must naturally be one which is sensitive to light) is decomposed slowly. It is found that one solution slowly becomes *dextro*-rotatory and the other *laevo*-rotatory. The explanation is as follows: in both cases, since the solutions are inactive, we start with an equal number of *dextro* and *laevo* molecules of the substance. Taking the case of the solution illuminated by the right-handed circularly polarised light, the beam, owing to its *dextro* nature, decomposes one form (say the *dextro*) of the substance quicker than the *laevo* and, therefore, the solution will slowly become *laevo*-rotatory.

A similar argument applies to the other solution, which is treated with the left-handed beam, this solution becoming *dextro*-rotatory. Since the solutions are treated side-by-side, at any moment the magnitude of the observed *dextro* or *laevo* rotations should be the same, and this has been found to be true.

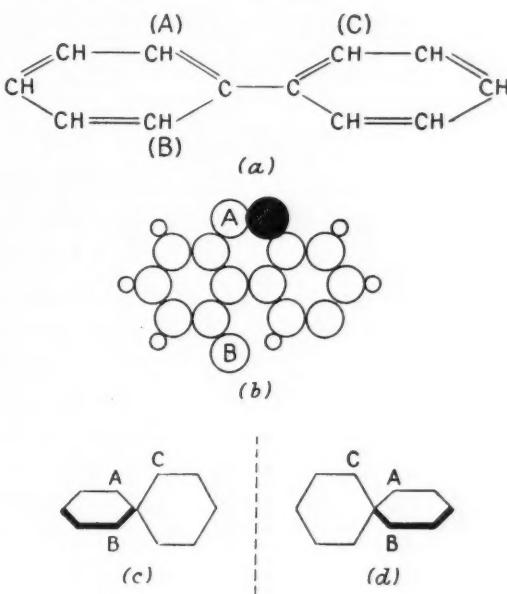


FIG. 3.

From Perkin and Kipping's Organic Chemistry, by permission of
W. and R. Chambers, Ltd.

This demonstration, however, although very interesting in itself, does not seem to offer a satisfactory solution to the problem, owing to the very special nature of the few substances so far examined and to the wide range of substances that the explanation must account for. The whole problem is also complicated by the fact that although in general nature produces either a *dextro* or a *laevo* form of a substance, several cases are known where the substance is obtained from one source in the *dextro* form and from another in the *laevo* form; and, to crown all, in several cases the two forms actually occur separately in different parts of the same plant. Thus the *d* form of one substance is obtained by extraction of the leaves of a tree and the *l* form is found in the stem.

Striking differences are found between the *d* and *l* forms of several substances when applied to the human or animal body. These distinctions have been summarised by Professor J. Read of the University of St. Andrews, in the excellent chapter on Stereochemistry in his *Text-book of Organic Chemistry*.

"A study of the physical and chemical properties of

enantiomorphously related substances shows the variation between them to be of a very refined character : the relationship provides, in fact, one of the most subtle distinctions known to science. It might seem that no practical interest could be associated with a difference of such apparent insignificance. It is, therefore, a peculiarly striking fact that physiologically two such substances may differ profoundly. As a simple example, *d*- and *l*-asparagine, which occur respectively in the vetch and asparagus, differ in taste, the former being sweet and the latter insipid. Natural nicotine, from tobacco, is *levo*-rotatory, and when injected into the animal organism it produces pain, excitation, and eventually death; *dextro*-nicotine, which has been produced synthetically, evokes only a strong temporary shivering when similarly injected. The plant henbane secretes a very poisonous alkaloid known as *l*-hyoscyamine, which exerts a powerful mydriatic action, or dilating effect, on the pupil of the eye ; *d*-hyoscyamine has little action of the kind ; and thus atropine, which is *dl*-hyoscyamine, is intermediate in its mydriatic action between *d*- and *l*-hyoscyamine. A further very interesting example of difference in physiological action is provided by adrenaline, an asymmetric organic base, which is secreted by the suprarenal gland. Natural adrenaline, which is *levo*-rotatory, has a marked constricting action on the blood-vessels, and is used in the form of subcutaneous injections for arresting bleeding. Synthetic *dextro*-rotatory adrenaline was found to exert only one-twelfth the pressor activity of *l*-adrenaline."

The great differences in physiological activity were thought by Pasteur to be due to the fact that the parts of the body affected by the various substances were themselves composed of asymmetric material capable of exercising a selective action. We have already seen, in considering the methods for the resolution of compounds, how bacteria or moulds can show this selective action by destroying one form. Pasteur, in 1860, marvelled at the wonder of this strange phenomenon in a characteristic flight of imagination.

" If the mysterious influence to which the asymmetry of natural products is due should change its sense of direction, the constitutive elements of all living beings would assume the opposite asymmetry. Perhaps a new world would present itself to our view. Who could foresee the organisation of living things if cellulose, right as it is, became left ; if the albumen of the blood, now left, became right ? These are mysteries which furnish much work for the future, and demand henceforth the most serious consideration from science." A new world ! It is a pleasant thought. Is this the kind of transformation that mankind requires at the present moment ?

The March of Knowledge

The Italian archaeological mission in Albania, working at Butrinto, has excavated a stretch of strong wall, of Greek work and dated to the fourth century B.C. This portion of the wall is thought to have comprised the main gateway facing the sea, flanked by two large towers. One of these towers is described as shaped like a horseshoe, while the other is rectangular. The entrance between them is about 10 ft. wide, and there are traces of the machinery for a portcullis. Other discoveries of Roman origin dating from the first century A.D. onwards comprise buildings used for baths, with elaborate water conduits and hot air ducts and numbers of columns.

On the site of the extension of the Bodleian Library in Broad Street, Oxford, the pickaxe of a workman, excavating 20 ft. below pavement level, has unearthed a mammoth's tooth. Experts from the University museum examined the relic, which is thought to be of the Mid-Glacial or Pleistocene period, and the tooth is to be placed in the museum.

A recent exhibit shown to the Linnean Society by Dr. W. B. Turrill revealed a remarkable number of native plants used in the Balkan Peninsula in place of tea. The required infusions were best obtained by boiling the plants in water for at least ten minutes. Among the plants used were species of *Tilia* (as in other parts of Europe), *Matricaria* (false camomile), *Salvia* (sage), *Origanum* (marjoram), and several of *Sideritis*. The last genus provided the most satisfactory " tea," and luckily is widely distributed over the Peninsula.

One of the largest adding-machines ever constructed, which was placed on display at a recent Adding U.S.A. exhibition, will add individual totals, sort the figures into as many as twenty-four groups, and total each group as well as the sums of all the groups combined. The machine measures some three feet wide by four feet high and three feet deep.

A new way to foil blackmailers and kidnappers has been devised in the U.S.A., where ransom money banknotes are being treated with a substance which fluoresces under ultra-violet light. A strip of this substance is painted on the note, which is dried with an iron ; the marks are quite invisible. It is intended that bank tellers shall have access to an ultra-violet lamp, and when the note is placed under this the strip glows brilliantly.

The Zoogeography of Central Asia

By Malcolm Burr, D.Sc., F.R.Ent.S.

A distinguished Russian zoologist, who has made a lifelong study of the zoogeography of Central Asia, has recently published his final conclusions. Dr. Burr here discusses his sub-divisions proposed.

THE vast regions of central and northern Asia are but vaguely known to the average Englishman, and even professed zoologists and botanists might be excused some hesitation in distinguishing between the Dzungaria and the Kirghiz districts,

for instance. This part of the world, however, has been much studied by Russian zoologists, and particularly by entomologists, who, for many years, have accumulated very extensive material.

Outstanding among these is Andrei Petrovich Semenov-Tian-Shansky, who has certainly an unrivalled knowledge of the general natural history of Russian Asia. The appearance, therefore, of a paper by him upon the boundaries of the zoogeographical subdivisions of the Palaeartic Region is particularly welcome. It was published by the Zoological Institute of the Academy of Sciences of the U.S.S.R., in December, 1936. As this very important paper is in Russian, it is desirable to give a summary of the author's conclusions in English.

For the sake of uniformity, he has chosen as basis for his conclusions the Coleoptera, the most numerous order of insects. There are well over 200,000 species known, about one-tenth of which occur in the Palaeartic Region, while of these, something like 16,000 occur within the limits of the U.S.S.R., representing 103 families. The numerous species of this Order offer an extraordinary diversity of manner of life, adapting themselves to almost every

conceivable condition of existence, and so occur almost universally. Further, according to Martynov, most of the existing families were already evolved by the Jurassic Epoch. Semenov-Tian-Shansky himself has erected over a hundred Palaeartic genera of different orders and described at least a thousand species. His connection with Central Asia is hereditary, for his father was P. P. Semenov, the famous geographer of the 19th century, who explored the Tian Shan mountains.

The general picture outlined by the author and his disciples, in other works, is that the elevation of the great mountain masses of Central Asia in the Tertiary Era led to the desiccation of the central portion of the continent by the shutting off of the moisture from the south. The fauna and flora, therefore, were subject to violent changes of conditions, leading to extinction or profound modification. While the western portion of the region was subject to the destructive effect of glaciation, the extreme eastern portion alone retains to-day some considerable aspect of the original tropical forests which extended, down to Miocene times, from Ireland to Malaya. His conclusions may not be accepted by everybody, and the author himself would probably be the first to admit modifications in detail, especially as in many instances the boundaries shade off insensibly with gradual change of condition. Although based expressly upon the



Andrei Petrovich Semenov-Tian-Shansky.

Coleoptera, the general conclusions will probably be borne out by other animals. They are, for instance, at least to a substantial extent, confirmed by the earwigs and Orthoptera, more particularly the grasshoppers.

Semenov divides the Palearctic Region into four sub-regions, each subdivided into a number of more or less sharply demarcated provinces, as follows :—

Semenov's Sub-Regions

1. BOR-EURASIAN SUB-REGION, comprising all Europe except the south, with most of Siberia. The fauna is poor. Of the 286 genera of palearctic *Carabidae*, only 87 occur within it, of which 5 are endemic. Holarctic and even more widely distributed genera are dominant. Here we have the maximum impoverishment from the rich Miocene fauna.

(a) *Arctic Province*. Few genera, mostly widely distributed species, mainly circumpolar. The zone of the tundra, bounded roughly by Lat. 70°.

(b) *Northern Forest Province*. Zone of the Taiga, including a belt of mainly coniferous trees, from north Scandinavia to the Pacific. Here is a more varied fauna, but many species common to Nearctic. He observes that the restricted area of many species is an indication of the impoverishment of the Arctic Tertiary fauna.

(c) *Central Forest or Woodland Province*. The zone of interrupted deciduous forests, accepted also by ornithologists. Here appears the fauna of Central Europe and all Britain (unless we exclude the north of Scotland), agreeing well with central Russia in species and genera; many deciduous trees are missing from Siberia, but reappear in Kamchatka (oak, maple, lime, ash, hornbeam, beech, and many shrubs).

(d) *Steppe Province*. This is the belt of treeless grassland that extends from Hungary, across southern Russia, to the Volga; it includes southern Rumania, Bessarabia, northern Bulgaria, the Crimea, and the north Caucasus plains, and corresponds roughly with the "Black Earth." Does not extend into Asia.

(e) *Caucasian Province*. The main range of the Caucasus has more in common with Europe than with Siberia, and traces of connection between the Caucasian fauna and northern Europe appear, and with points in the Balkans and Asia Minor. Semenov points out that all the northern forms occurring in the Caucasus are species to which the steppe does not offer an obstacle.

2. MEDITERRANEAN SUB-REGION. From the Canaries to Mesopotamia. A rich fauna. Of the *Carabidae*, 169 genera are represented, of which 63 are endemic. Here is a substantial survival of Tertiary fauna which escaped the glaciation, but was affected by greater aridity.

(a) *Canary Province*. High endemism in small area; he includes Madeira.

(b) *West Mediterranean Province*. Roughly, Spain and Portugal, Italy, Morocco, Algeria and Tunis, southwards to Atlas.

(c) *Saharan Province*. Part of the Eremian Desert Belt, which extends across the Old World, corresponding to the Turanian Province of Central Asia, with which it has much in common, both in genera and species which are extinct in the Eastern Mediterranean.

(d) *East Mediterranean Province*. Perhaps Anatolian would be a more convenient name. It is roughly the Levant, including the southern Balkans, southern half of the Crimea, the Black Sea Littoral of the Caucasus, and part of Transcaucasia. Has many general features absent from West Mediterranean and a good deal in common with Central Asia.

(e) *Sumerian Province*. Mesopotamian or Arabian would perhaps be a better name. It is the connecting link between Asia and Africa; it contains mainly desert types, and extends from Sinai to the Caspian.

(f) *Syrian Province*. Formed for the mountainous parts of Syria, where there is a considerable relict fauna from the Miocene, and a few elements of even greater age.

(g) *Hyrcanian Province*. The southern shores of the Caspian, the Elburz mountains, including the wooded region of Luristan and other parts of Western Persia, with the Lenkoran and Talysh, have retained more Miocene relicts than the Levantine or Caucasian provinces, e.g., one species of *Parandra*.

3. CENTRAL ASIAN SUB-REGION.—This sub-region is defined by Semenov for the first time. It covers a vast area from the eastern shores of the Caspian and Persian Gulf to the crest of the Great Hingan, that is the eastern boundary of Mongolia. On the south it is bounded by the Indian Ocean, the valley of the Indus, the Hindu Kush, Karakoram, Kuen Lun, Nan Shan, and the mountains separating Mongolia from northern China. On the north it is bounded by the limits of Mongolia, Dzungaria and the Kirghiz Steppe, except the valley of Zaisan, northern shores of the Caspian, southern Volga and all the semi-desert districts of the Transcaucasus and northern Caucasus.

High Specialisation

With the exception of the Iranian Province, which links it with the Mediterranean on the west and north India on the east, it is a very homogenous area. It is poorer than the Mediterranean Province, but much more specialised, owing to its history. It carries only 88 genera of *Carabidae*, with only 17 endemics, but in other families of the Coleoptera there is a long series of highly characteristic genera restricted to this sub-region. Many of them cannot really be regarded as adapted to changed conditions, and there are many

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remarkable forms which bear the stamp of ancient origin, even from the Cretaceous. On the other hand, the impoverishment and high degree of specialisation of this sub-region is seen in the absence of whole families and other groups of beetles well represented in the Mediterranean Province, and common to that and to the Far East as well as to parts of the Europe-Siberian area.

The fauna is closely related to that of the Mediterranean, but has many genera in common with the Turanian Province, and also a series of endemic genera.

(b) *Turanian Province*. Comprises all Turkmenia, the eastern parts of the Transcaucasus, all Turkestan, both western and eastern, the Pri-Balkash sands, but excluding Semirechie and Dzungaria. It is the most



Map of Central Asia, showing the zoogeographical boundaries as laid down by Semenov-Tian-Shansky.

This marked specialisation is seen particularly well in its desert and semi-desert districts, in the wide adaptation among beetles there to subterranean life, among the roots of plants, to the persistence of the imago through the winter and early spring. Many have found refuge, at least at times of maximum insolation, in the lower layers of the soil, where the range of temperature is narrower and humidity greater. Many have adopted mammalian burrows. Another marked feature is the presence of a rich and varied fauna that shows itself in the imaginal state only at night, or adapted to the early spring season, all features to escape the intense heat, which distinguishes this from the adjoining sub-regions. To the present day it is a centre of active species formation, especially on the mountain heights, as witnessed by numbers of extensive complexes of young, highly localised species and genera.

In the mountains there are preserved relicts of Tertiary times, when a tropical fauna and flora extended across the continent. Some striking instances may be seen in the Orthoptera.

(a) *Iranian Province*. Comprises all Persia except the western edge, and the greater part of Afghanistan.

typical province of the sub-region, with the greatest number of endemic genera. The fauna of Chinese Turkestan cannot be separated from it.

(c) *Dzungarian Province*. Dzungaria has much in common with Turan, but has a marked northern element, mostly in the coniferous belt of the Tian Shan. It comprises Semirechie and the Tian Shan.

(d) *Kirghiz Province*. Comprises all the Kirghiz Steppe from the lower Volga and north-west shores of the Caspian to Zaisan. It differs from the Turanian in its impoverishment in genera, and in the presence of a series of genera unknown there, many having a Mongolian element. It is covered mostly by *Artemisia* steppe, the sandy areas tending towards the Turanian fauna.

(e) *Mongolian Province*. Comprises all Mongolia, except the wooded mountainous portions in the north, which belong to the Taiga. Otherwise Mongolia has a clearly Central Asiatic character, as seen in both species and genera. Many typical Kirghiz elements extend to the southern boundaries of Mongolia. The Mediterranean element visible in the Turanian, Kirghiz, and even Dzungarian Provinces, is entirely absent from here.

4. THE PALÆARCHÆARTIC SUB-REGION. This is the Sino-Himalayan zoogeographical province of Severtsoff, renamed by Semenov-Tian-Shansky in 1899, the Palæanarctic. He now regards it as a sub-region of the Palæarctic and has renamed it once as above, inserting the syllables “-archæ-” in order to emphasise the presence on it of so much of the ancient Tertiary fauna and flora. The disadvantage of this word is its length. It is more convenient to refer to it as the Far Eastern. Its fauna corresponds in the east to the Mediterranean fauna in the west. It is characterised by a fauna which represents the Miocene, in places even the Oligocene, the primitive original fauna of the Bor-Eurasian and nearest of all to its forest zone. Owing to the persistence in the Far East of a great measure of the Miocene humidity and its exemption from glaciation, there are here many more relicts of the early Tertiary days than in the west, affording a fairly complete picture of the extent of many genera and other groups, which have been heavily reduced, or even exterminated, in the west.

Compared with the Mediterranean, however, this sub-region has been relatively little studied. In spite of that, the number of genera of the *Carabidae* already known amounts to 153, of which 39 are endemic.

Late Persistence of Land Connection

In its genera this sub-region has much in common with the Sonoran sub-region of the Nearctic Region. This fact is well illustrated by the possession in common of many trees, such as magnolias and liquidambar. The author sees here evidence of late persistence of land connection. The sub-region is marked by absence of deserts and steppes, and consequent feeble development of the *Tenebrionidae* and some other groups, as well as by the presence of the Tertiary relicts scarcely possible in other parts of the region.

(a) *Manchurian Province.* Here there is a marked forest element from the Taiga, with an Indo-Malayan element, as well as a series of genera common with North America, and a few that are known to-day only from tropical America. It covers Manchuria, Ussuria, Southern Sakhalin, middle Pri-Amur and basin of the Yalu and northern Korea.

(b) *Korean Province.* All Korea, except the northern belt. Here there is a higher proportion of Indo-Malayan forms, with fair, specific endemism.

(c) *Japanese Province.* The Japanese archipelago, but not Formosa. This has much in common with the Manchurian Province, but has a number of island forms and a higher Indo-Malayan element, especially in the southern islands. Semenov-Tian-Shansky notes the absence of certain genera as characteristic.

(d) *North Chinese Province* (called by the author

Inner Chinese Pr.). Comprises all inner China, except the southern provinces, the eastern wooded slopes of Tibet, and parts of Kuku Nor and the Nan Shan. Owing to the varied relief, the fauna is rich, with a number of Miocene and even Oligocene relicts. Quite a marked Miocene area is in the mountains of Szechuan, lower Hansu, and east Tibet. This is probably the most outstanding picture of the Miocene fauna available in the whole of the Palæarctic Region. It is, from our point of view, paradoxical that it is here that we must look for light upon the past of the palæarctic fauna, especially of the Europe-Siberian belt.

(e) *South Chinese Province.* Comprises the rest of southern China, except Yunnan and the extreme south, which passes into the Oriental Region. Here, there are no lofty mountains, and the fauna is transitional to the Oriental Indo-Malayan, with a high percentage of tropical elements. The palæarctic element is seen in many genera unknown to the Old World tropics.

(f) *Yunnan Province.* The high relief of this province has preserved many ancient elements, and the rich and varied fauna contains a series of outstanding endemics. There is a connection with Tonkin, outside the Region.

(g) *Tibetan Province.* The Tibetan plateau, without the eastern slopes, without the Kam, and apart from Tsaidam, which the author refers to the Mongolian Province. The fauna is highly impoverished and specialised to the high altitude of 12,000 ft. and more, and is very different from the Chinese. It is more analogous to the Bor-Eurasian Province, with which it has much in common. Still, in the main, the fauna is peculiar, the result of adaptation during the slow elevation of the country since the Miocene. As it has risen as a whole, the Chinese-Himalayan elements have been evenly and equally modified over the whole area. Only the north-west of Tibet, with a marked impoverishment of fauna, has a somewhat mixed character, with immigrants from Central Asia and especially from Turan. Also the north-east corner, Kuku Nor, and the Nan Shan, has a character not quite typical, with an admixture of Mongolian elements.

(h) *Himalayan Province.* Comprises the Himalayan range, with the Karakoram and most of the Hindu Kush, the latter poorly known. This province is marked by the rich development of Miocene types, though, in the mountains of Kashmir, Sikkim, and Nepal, its richness and variety are less than those of Inner China, with fewer relicts. Species common to Turan and the Himalayas and even Dzungaria must be regarded as direct Central Asia relicts of the Tertiary fauna, left as survivals but with their area dismembered from the Himalayas to the present Za-Illiski and even the Dzungarian Alatau.

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A New Roman Villa in Sussex

By S. E. Winbolt.

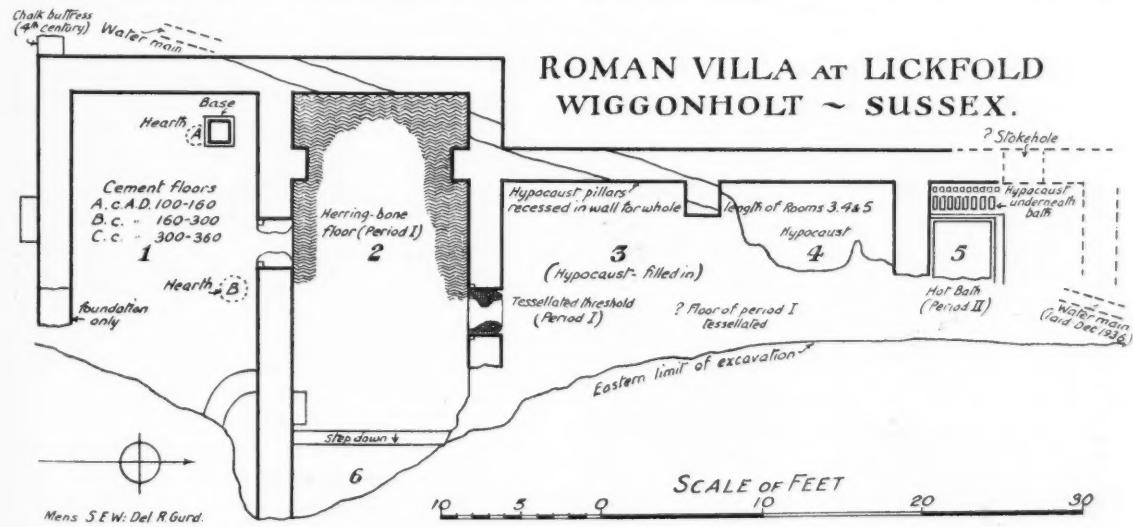
The discovery and excavation of a new West Sussex site.

MANY are the ways in which clues have been given of the existence of Roman walls under the ground surface. In my own experience the cleaning of a ditch round a wood revealed tesserae of a mosaic floor; the mouth of a disused drain at a cliff edge contained Roman pottery; the soil of a market garden was full of shards of tile and pottery; and this time it was the sinking of a water main in a long-suspected field. Very often the plough has found the first indications of sites with a shallow covering. The pipe trench had been filled in when I reached the spot, but the workmen had brought some tell-tale pieces of Roman flue tiles to the surface; when questioned they had no idea what they had broken through three feet down. The symptoms seemed interesting, and in the result handsomely justified the diagnosis and the somewhat elaborate organisation of a "dig." Mr. R. Goodchild, whose excavation of a fine Roman tilery at Ewhurst, Surrey, was recorded in DISCOVERY (Sept. 1936), made an excellent lieutenant, from whom Mr. J. Reid Dick took over latterly.

The site is close to the right-hand (west) side of the road from Pulborough to Storrington, about half-way between Wickford Bridge and Wiggonholt Common, and at the foot of the east slope of Lickfield, a big field

with the road and deeply buried, but one hardly anticipated going down 5½ ft. to a floor. This is the deepest excavation I have made for a Roman villa—wall tops are generally struck within two feet—and the most laborious so far as the shifting of great buttresses of soil between successful trenches was concerned. The consolation was that deep silting meant exceptional preservation: good walls were commonly standing 3 ft. high, floors were exactly as left when the house was burnt down and deserted, with plenty of coins and other "finds" not picked over by Saxon hands. The burnt débris of roof, wall plaster, and the masonry of toppled walls most effectively covered the floors to the remaining height of the broken walls, and quick silting of the sand from the slope above soon sealed the place, so that we found it as left by the Roman-British inhabitants: no subsequent squatters cooked meals inside this "coldharbour," or removed the valuable big tiles or faced stones for adjacent buildings.

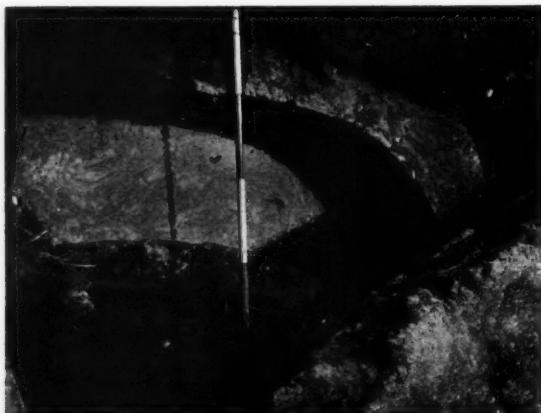
On the north we were unable to move for a springing crop of wheat, and on the east, where we knew the rest of the rooms were, a hedge-bank and a motor road stopped proceedings. This was most tantalising; but we were well satisfied with what was uncovered, parts of



of sand over gravel, which makes a promontory a quarter-mile wide between the Arun and Stor flats. The slope suggested that the remains would be parallel

six rooms and excellent dating evidence. The length of the house dug out was 61 ft., and the greatest width 27 ft. Of Room I at the south end, which had a small

garden outside it on the south, the dimensions were 11 ft. 6 in. by 27 ft. so far as could be excavated—an exceptionally interesting room. In the N.W. corner was the base of an altar, rising in two stages, 21 in. and 17 in. square, separated by a rounded moulding. A burnt patch in front of it on the highest floor was the result of continually brushing off ashes from the altar top; and the number of copper coins found near it suggests that the deity there worshipped, possibly the *genius huius loci*, was placated by small monetary offerings. Under the north-east corner was found in "mint" condition a wide tiled drain, 2 ft. deep and 1 ft. 9 in. wide, the function of which was to drain No. II, an open court. It is seldom that the archaeologist has the luck to find such neatly dated horizons as Room I supplied, for it had three sealed floors with coins and pottery on each. The lowest, a thin concrete floor, was laid over natural sand about A.D. 125, and lasted till about 175. Hadrianic and Antonine coins with pottery of the period, and a few worn survivals from the time of Domitian and Trajan were found on it. Of course this was the last of the three floors worked down to by an assiduous and very careful team of trowellers, who eventually destroyed all three, because the floors were nothing compared with the dating material on them. After the lowest floor had been worn out in this, the busiest room in the house, 5 in. of sand was spread on it, and on this was laid a floor of bits of stone and tile bound together with cement (*opus signinum*). On this, among other things, were shards of New Forest and Castor wares and third-century coins, with a few survivals from the previous period. This floor did duty for a century and a quarter till about A.D. 300, when the top floor, a poor makeshift thing of flat stones and tiles, was laid, to be effectively sealed in about 364-8 by a layer of fallen



View from above of the drain in Room I.

plaster, tiles, wall-stones and ash. The walls of this room, as indeed all the original walls of the building, were strongly made of Pulborough stone all through their 2 ft. thickness, with a course of bonding tiles 7-10 in. above floor level—not, as often, rubble-filled and ashlar-faced. Their interior faces were covered with creamy plaster, mottled pink and with bands of Pompeian red.

We proceed into Room II, an open court 11 ft. 6 in. wide and 19 ft. 9 in. long, by a doorway 3 ft. wide, retaining two post-holes on its threshold, and a step down of some 5 in. from the latest floor of I on to a very well preserved herring-bone floor (*opus spicatum*), which served during the whole 240 years of the life of the villa. Such longevity might seem questionable, but an examination of its construction dispels doubt. It was laid on at least 8 in. of very hard concrete, itself resting on a solid bed of rubble of tiles, such tiles as the Romans made. Thin yellowish tiles, 4 in. deep, were set edge-wise with thin joints of adamantine pink mortar. Each tile is 5½ in. long and ¾ in. wide, and a 1 ft. length of a *spica* (ear of corn) requires 20 tiles, 10 on either side. In places where the wear was greatest, the tiles have been worn down to a depth of less than an inch. Along the west wall they were very little worn for a foot out,



A complete floor of herring-bone tiling, 20 ft. by 11 ft., dating from the reign of Hadrian. This is 5½ ft. below the modern level.

and then there was a slope down of about 4 in. to the general level. Here was probably a seat fixed against the wall to catch the morning sun: the feet of many generations had worn the tiles away. The floor was slightly sloped down eastward to carry off rain water to the drain. Fond as the Romans usually were of buttresses, there was special need for them here on a sand subsoil; the walls of the court are supported by

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three internal buttresses and one external in Room I, all 2 ft. wide and 1 ft. deep. At the east end of the court and about 16 in. below it was Room VI, with a solid concrete floor, reached by two steps down; and this suggests that the whole east side of the villa, with five or six more rooms and probably a corridor, was on a lower level, extending to the edge of the flats of the Stor valley, then several feet lower than to-day: otherwise the drain in Room I could not have found an outlet.

We enter Room III by a doorway, also 3 ft. wide, the jambs retaining on the south side the slots into which



Room III : A perfect series of eight tile pillars, with capping tiles, which originally supported a tessellated floor.

the wooden doorposts were fitted. This room too has an interesting history, for its floor of one-inch tesserae was originally suspended over a hypocaust some 2 ft. 9 in. deep. In time economy dictated the filling in of the hypocaust with rubble largely consisting of the tiled pillars. The row of pillars, however, which was somewhat unusually recessed 7 in. into the strong west wall, was left intact. Its eight pillars, with a six-inch space between them and big capping tiles complete, are beautifully preserved. I have nowhere seen so good a survival. The latest floor was a rough, slap-dash product, and like other reconstructions here shows a sad deterioration from the builder's craft of an earlier period. It is the common story of progressive deterioration among the Roman-British: the heyday of this house was the half century between A.D. 125 and 175.

The run of west wall bounding Rooms III, IV and V, as originally built was intended for hypocausts for all three rooms. In the latest period only IV and V retained hypocausts. Room IV, the latest tepidarium (warm room), was divided from III not by a continuous wall with doorway, but simply by a pair of buttresses 2 ft. long, of which only that which projects from the west



Room V: The west end of the hot room of the baths, with a double row of blue tiles. The laying of the water-pipe (bottom right) did much damage to the bath system.

wall was found standing, as the eastern walls of III, IV and V, also had been toppled over, probably by flood after the final catastrophe. The original floor of IV was, of course, red tesserae, some of which were found in position near the south buttress, but later a cement layer covered the tessellation.

Room V, the sudatorium (hot room), was originally entered by a similar opening between buttresses; but at a reconstruction the west buttress was extended eastward by a roughly built wall with a straight joint, and the hot room remodelled and shortened. We found its pink plaster floor, 4 ft. wide (length uncertain), with a quarter-round skirting against the walls, which were frescoed with Pompeian red. Another row of bigger flues had been inserted inside the original row. The stoke-hole and arched entrance to the furnace we could not find, being precluded here by a crop of young wheat. But on the whole we felt satisfied that there was little to find on north, west and south: the east only left us wishing.

Here then we have a villa or manor-house built probably by a well-to-do romanised Briton in the days of Hadrian, the boom period of romanisation, and, with many repairs and reconstructions, lasting till the reign of Valentinian I. From the point of view of the farming then in vogue, the owner's estate was "extremely eligible," for it spelt easy cultivation of light soil, some hundred acres of which was available, well drained and sloping down to water on three sides. There can be no doubt that it was served, like the Borough Hill and Home Street farms to the north, by a Roman road which passed close to the west of the villa, a road which branched off from Stane Street at North Heath, north of Pulborough, and made for the east-west Roman

routes, one under the north escarpment of the South Downs, the other the prehistoric route along their top. There are very clear indications of the remains of three other Roman buildings within 70 acres, dependencies of the villa. The end came to this prosperous settlement with fire and pillage, possibly in 368, when a fierce four-fold co-ordinated attack was made on the south of Britain by Picts, Scots, Saxons and Attacotti, whose obvious route was up the Arun estuary, around and at the head of which was an intensive romanised settlement second to none on the coast of Sussex. In the middle of last century was found half-a-mile to the south-east a big hoard of coins hidden near a spring, the latest of which coins fit our date. It may well be that the fugitive owner of the villa made this cache hoping to return and recover them.

Exceptional in other respects, this villa was particularly rich in "finds." Pottery of all the periods—Samian, Castor and New Forest included—is represented. Bronze articles were numerous, brooches, rings, tweezers, hairpins, etc. In glass we have part of a necklace of minute beads threaded on copper wire, and window and vessel glass; and most of the usual objects. But the richest item is coins, totalling 70, the majority being found in Room I. These range from a worn Domitian and a few Trajans to Valens, the Antonines and the third century emperors being well represented. Best of all is that the labour of excavation will not be lost, because, apart from reporting, in Captain the Hon. Clive

Pearson, of Parham Park, we have a landowner who objects to filling in a historic site which ought, if by any means possible, to be kept open for the instruction of the public. The place will be protected and kept open, i.e., it will be fenced, turfed and planted round, roofs will be built over the courtyard and the more worthy rooms, while in the court will be exhibited the objects found. Such a public-spirited effort is bound to find appreciation: a road within a few yards should ensure many visitors.

I close with some information seldom vouchsafed, which may be of service to some future discoverer of a Roman site and eventually to historically-minded people. Imagination generally boggles at probable expenditure, and the thing is not done, or what is worse, is tampered with, half done or left to a succession of excavators, enthusiasm waning in the process. The cost of excavation and report was £55, including four weeks of work with four diggers (8 hours a day) and part expenses of supervisors. Added to this was the cost of carting away a great quantity of soil not filled in again; in a normal case of covering up the filling in would have meant four or five days' more labour, say roughly £7 more. Preservation, which falls on the landowner, is, of course, a separate account, and will entail probably twice as much expense again. But once fenced, roofed and equipped, the site should pay for upkeep out of the small entrance fees paid by visitors and the purchase of printed guides and picture postcards.

The Friends of Progress : 1754-1937

HAD it not been for the enormous interest aroused by the Art in Industry Exhibition at Burlington House two years ago, many people would still be in ignorance of the way in which the Royal Society of Arts is striving to bridge the gap between art and commerce, and even now comparatively few realise the great influence which that Society has had upon the progress of science and art in industry.

A small exhibition, placed on view with too much modesty for only eleven days at the John Street, Adelphi, premises of the Society recently, told an eloquent story in terms of mangel-wurzels, hand-bills, and steam-trams. That is to say, among the many interesting exhibits were a group of swedes and mangel-wurzels, standing for the Society's efforts to improve agriculture in the 18th century; a handbill of the Society of 1777 offering a gold medal for the transplanting of bread-fruit trees, which Captain Bligh went out to earn and ultimately gained in 1793; and a model of the double-deck steam-tramcar, built in 1870 by John Grantham,

the result of the Society's offer of a gold medal for an improvement on the horse-tram.

A small exhibit of great significance was one of the famous "shilling colourboxes," sponsored by the Society and sold to the extent of eleven millions between 1852 and 1870. It was the Society, too, who offered an award for an instrument to obviate the boy chimney-sweep, and a brush similar to that which solved the problem in 1805 was on view.

Some of the most interesting exhibits were the Minutes of the first meeting, at Rawthmell's Coffee House on March 22nd, 1754, written in the beautiful copperplate handwriting of William Shipley, the first Secretary, and the subscription book of the earliest members of the Society, containing the signatures of most of the famous men of the day, such as Samuel Johnson and his associates, the brothers Adam, Edward Gibbon, Samuel Richardson, Thomas Chippendale (the only known autograph still extant), Lord Romney, and many other members of the nobility.

(Continued on page 222)

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JOHN CONSTABLE, the first Englishman who painted Nature as he really saw her, died on March 31st, 1837. He was a painter whose style varied surprisingly; and a representative collection of his works, showing Nature in the many moods—both hers and his own—in which she appeared to him, is now on view at the Tate Gallery, Millbank.

Constable's career was an example of the fate of many great men who have received more honour both abroad, and from a later generation, than in their own country and their own lifetime. Yet he had a measure of success in England, and while he lived, for he sold many pictures, though at ridiculously low prices compared with those they fetch now (e.g., he sold "Stratford Mill" for 100 guineas; it was bought in 1894 for 8,500 guineas, and more would probably be paid for it were it to come into the market to-day). And he was elected to the Royal Academy, but only at the late age of fifty-two, after 28 years' work.

He was born in 1776, the son of a miller, near East Bergholt, Suffolk, beside the same quiet stream in whose valley stands Sudbury, the birthplace of Gainsborough. It is perhaps not surprising that Suffolk, with its wide skies, its clear air and fresh breezes, its ever-varying contrasts of brilliant sunshine and dark storm-cloud, should have produced two of our best landscape-painters. For great, and deservedly so, as is Gainsborough's fame as a portrait-painter, he really preferred landscape, as is shown by the predominance of nature-studies of trees, clouds, rocks, etc., in his sketch-books.

Constable, on leaving school, followed for about a year his father's trade, but his heart was always in painting. In this he was encouraged by the famous connoisseur, Sir George Beaumont (whose mother had a house in the Stour valley). When eighteen or nineteen, young Constable was allowed by his father to go and seek his fortune in London; four years later he became a Royal Academy student. He had an intense admiration for the Old Masters, especially Claude, Ruysdael, Rubens—in his rare landscapes—and our own Richard Wilson (who may surely, on the strength of his truly classical style, be numbered among them). This, and his Academy studies, stood him in good stead, for they enabled him to overcome his curious lack of natural facility; and, in 1801, he exhibited at the Academy.

To overcome the opposition, made for financial reasons, by the relations of the girl he wished to marry, Constable executed commissions for copying pictures, and for portraits; both of which might, in his case, be termed hack-



[From Holmes's "The National Gallery: France and England," by permission of Messrs. G. Bell & Sons.]

On the Stour near Dedham, from the oil sketch in the Victoria and Albert Museum.

work, for he was not fond of portrait-painting. Yet the heads of his wife, and of an unknown girl that he painted are beautiful little pictures, showing his unfailing eye for colour-harmony and for expressive texture. But it was in landscape that he showed his originality; he painted canvas after canvas, each more "modern" in effect than the last—many of them far more so than those of any of the Victorians. Gradually he "made his name," but it was not until 1824—and then in France—that he aroused any enthusiasm.

In that year he exhibited in the Louvre two pictures (one of them our National Gallery "Hay-wain") that not only gained him a gold medal, but also influenced the course of French art for the rest of the century. For his simple, straightforward methods were then quite new. Much as he venerated the Old Masters, he had the courage to paint the world as he saw it, leaving out the "brown sauce" in which, till then, most pictures had been smothered. This consisted not only of a dark under-painting, covering the whole canvas or panel, and on which, while still moist, the half-lights were scumbled in cool opaque pigment, but also of successive coats of transparent warm colour, with which the whole work, including even the high lights, was glazed over. This had the effect of harmonising the picture; and Constable himself did not disdain the use of a warm monochromatic under-painting; but, early in life, he abandoned glazes, thus gaining immensely in freshness of effect.

The development of his art is highly interesting; and may, roughly, be divided into three stages:

(1) 1801-1819. At the beginning of this period his water-colours showed, perhaps, more promise than did his oils, which were apt to be somewhat hard and dry, the result, probably, of his great admiration for, and over-imitation of, the Dutch painters. Their works still abound in East Anglian country houses, and Constable had many opportunities of copying them and of absorbing their style. But his constant study of

Nature, which made necessary more direct methods, and his fidelity to her in all her quickly-changing aspects, led him to make a great many rapid sketches. Gradually he acquired dexterity of hand, and his brushwork became looser and more liquid, and his colour fresher and brighter, until he attained to the broad atmospheric style of such pictures as "Malvern Hall" and "On the Stour near Dedham."

(2) 1819-1829. During these years he produced his most famous works, such as "The Cornfield," "The Leaping Horse" (his chief Diploma picture), "The Hay-wain," "Salisbury Cathedral," and "Stratford Mill." These all show fine composition, broad massing of light and shade, a taste for brilliant yet delicately-harmonised colour, a strong indication of the structure of things without any stressing of detail, and—above all—the power to fill his paintings with life and movement. As has often been said, one can feel the wind blowing in them. His pictures varied in size as much as in mood; and one does not know whether most to admire his courage in embarking on a huge canvas (the sketch, even, for the "Leaping Horse" is 6 feet long), or the astonishing assiduity and skill shown in his almost innumerable studies measuring only a few inches each way—each one a marvel of beauty.

One at least of his pictures of this decade, the "Salisbury Cathedral," that hangs normally in South Kensington Museum, anticipates, in its bold style, thick pigment, and brilliant colouring, his last period, viz., 1829-1837—

1829 was the year of his wife's death, which affected him deeply, both mentally and physically. But it caused no deterioration in his work; grief and ill-health only altered his style, which showed now an unrest, and a reckless boldness of handling (fully justified, usually, in its results, though his use of the palette-knife causes sometimes a disagreeable unevenness of surface). He showed, also, at this time, a preference for scenes of overcast or unsettled weather—gales and thunderstorms rage in the works of his last few years—in harmony,



[From "The Painter's Eye," by E. Glasgow, by courtesy of Messrs. Faber and Faber]

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no doubt, with his mind's unease. Though occasionally he produced a painting of serene but melancholy beauty, both in style and subject, such as "The Cenotaph," his works of this period are, almost all, full of storm and stress. This appears in "A Mill Near Brighton," "Salisbury Cathedral from the Meadows"—the picture in which the Cathedral is dwarfed by the great rainbow—and "Hadleigh Castle," bought for the nation only some two years ago. This last is a magnificent work, best seen at as great a distance as is practicable when all the apparently meaningless shapes in the foreground will be found to fall into focus. In this picture, as in others of his latest period, Constable anticipates the methods of the French "Impressionists," so-called, of the 'sixties and 'seventies—the painters who took light and air as their principal subjects, and painted Nature, not as a blind or colour-blind man might be told that she looks, but as anyone with normal sight and colour-sense really sees her, and leaving out superfluous detail. Some of the works of these men may be seen in a room, at Millbank, adjoining those in which the Constable centenary exhibition is on view; and it is instructive to walk round this room after seeing the Constables, and to observe the similarity of treatment: "local colour" giving way to reflection of light and of sky-colour, the clever brush-work, even such details as the thickness of the paint. Nothing of the kind had been seen in France till Constable's time, nor did it appear till some years after his death. Then Corot showed traces of his influence, and it was fully developed by Manet, Renoir (in his flower-pieces especially), Claude Monet, Pissarro, and Gauguin.

British Association News

The British Association has recently received from Miss Hooker, daughter of Sir Joseph Hooker, a gift of the aneroid barometer which used to hang by the fireplace in Charles Darwin's "old study" at Down House, where it will now be replaced. A small repair has been kindly carried out by Messrs. Negretti & Zambra, and the aneroid is in working order. The face bears the



[From Holmes's "The National Gallery: France and England," by permission of Messrs. G. Bell & Sons.]
Windmill near Brighton, from the oil sketch in the Victoria and Albert Museum.

Their tradition has been finely carried on in our own times by such men as Mr. Wilson Steer, but few of our younger painters have, in these days of self-expressionism, the necessary humility, patience, and self-effacement. As John Constable said, in the last of his lectures on landscape: "No arrogant man was ever permitted to see Nature in all her beauty."

words "holosteric barometer" and beneath them the figure 19, but no maker's name; the usual verbal indications of weather conditions are provided, and the dial is graduated continuously round the whole circle, figured from 25 in. up to 31 in., the remaining arc, between 31 and 25 in., being also graduated, as the whole scale is, in fiftieth parts of an inch. A small label, affixed perhaps when the instrument came into Hooker's possession, bears the name of "C. Darwin."

The Huts of Velika Planina

By F. S. Copeland

To the visitor from the West to Yugoslavia the whole of the ancient Duchy of Carniola appears as a lost world, surprisingly beautiful and interesting, and here the dwellings of the inhabitants of one of the mountain pasture regions are described, and their possible origin traced.

THERE is a pastoral settlement on Velika Planina : a group of about fifty huts stands clustered round a very wide dolina in the shelter of the highest elevation (1,660 metres) and near the largest of the meres, a crescent-shaped water at the bottom of a dolina, enclosing what looks like lush grassland, and is mainly a quaking bog. Perhaps the dolina was more of a lake when the first settlers came here. The construction of the huts was adapted, it is said, from that of the nomad Avar's tent, which would take us back to the sixth century, when a wave of Slovene immigration followed in the wake of the Avars. For myself, I wonder whether the principle of construction is not the same as that of the dwellings originally reared upon the prehistoric hut circles of Scotland, or at least something very similar.

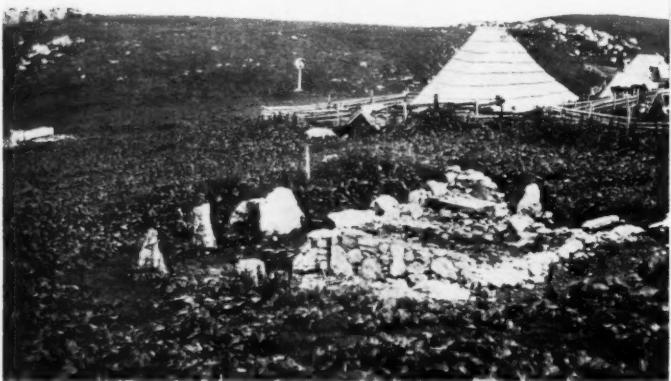
First comes a circle (about 24 ft. in diameter) or oval (24 ft. by 27 ft.) of large stones, about two feet high. Sometimes the circle is complete, more often indicated by about a dozen uprights placed at regular intervals—if a bit of live rock should fit into part of the circle, so much the better—next, our builder erects a foursquare blockhouse in the centre, and a stout little cell-chamber (about 9 ft. by 9 ft.), raised about three feet above ground on a pier of stones and wood blocks. In one corner is the open stone hearth, and opposite the door the bed-shelf. Sometimes there are two shelves, super-

imposed like berths in a cabin. The free space on the walls is lined with shelves for the earthenware pots and dishes required in very primitive dairy farming. The pottery is primitive, too, and hand-made in the neighbourhood. A continuous bench along the wall and below the bed-shelf completes the fixtures. Now the intervals between the circle stones are filled in with a palisade of boards inclining outwards.

Then comes the roof. First, there is a skeleton construction of long wooden bars surrounding the chamber, like the frame of a crinoline. On this is laid the roof of shingles, shaped like a tent with a roof-ridge, the lower edge projecting slightly beyond the wall of stones and boards. In the original type of hut there is no window, let alone a chimney. Smoke gets out, and light in, by a moveable board in the shingle roof. The space between the inner chamber and the sloping roof is divided up by radial wooden partitions ; the rear parts serve as tool and store sheds, the front as byre and milking-shed. The outer entrance through the wall and under the shingle roof is usually well under five feet high and never directly opposite the stout wooden door of the chamber, which is scarcely higher. The openings usually face west or south. There is nothing occult about this arrangement : it minimises draughts and lets in only the warm winds.

In these prehistoric huts well-to-do peasants from lowland farms scattered over many miles of country spend the summer months. When a board rots, it is replaced. If a hut burns down or collapses from sheer old age, red-headed Peter, the master-builder of Velika Planina, will put up another one near the old site, exactly like its predecessor. He is doing it now, shaping the rafters with an axe, as his forefathers have done time out of mind. In a few cases the old pattern of hut has been slightly modified to suit modern ideas and one side of the roof cut away so as to expose a wall of the chamber, which is then provided with a cottage window opening to the air. But the principle of construction has remained unchanged.

I have asked everybody likely to know anything about it, how old these settlements



A hut-circle, showing the pier on which the cell-chamber was reared.

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might be. "I don't think there is a hut here older than 200 years," was the most definite answer I received, "because you can't go on replacing boards indefinitely, and a hut has to be abandoned, even if it does not burn down or fall to pieces with age." "And before these huts stood here?" I went on. "There were others," was the reply, "just like them." "Yes," I thought, "and before them, others just like them, and so on, back to the time of the first shingle-builders." It is the oldest form of dwelling for states and countries around. And the queer thing is that it is peculiar to Velika Planina, and one other spot quite near. I have been told that there is another settlement of the same character somewhere in the Rhaetian Alps. On all other *planine* in the Jugoslav Alps, the huts are of the ordinary *chalet* type. Even the *katuns* of Montenegro, though primitive in their way, are definitely houses, not structures that look as if they had been evolved from the tent, or even (more likely, I think) from the earth-covered dwellings of prehistoric ages. What is the special reason for this atavism in domestic architecture?

The main reason certainly is that the Velika Planina huts are admirably suited to the place. They are not liable to be crushed by snow as are the ordinary chalets, and, unlike these, they were surely designed originally to serve as habitations for man and beast all the year round—if necessary, at least. Ten years ago it was said that one could not winter in one of them on Velika Planina. Since then, a fairly large number of young folk, who object to wasting the prime of their youth on classroom forms, have proved that you can winter in these huts, and combine it with excellent sport on the snow. There is first-class ski-ing on the undulating ground of the Great Fell, and in this connection we might remember that ski-ing is indigenous in parts of Carniola. The first written record of it (in Valvasor's classic, *Honour of the Duchy of Carniola*, 1689) expressly states that the natives of Bloke, in Inner Carniola, had at that time practised their art of gliding about the snow on long boards, for how long nobody knew.

Who was it first lived on Velika Planina? Are our Slovenes of to-day their direct descendants, or did they only displace the mysterious folk who flit through Slovene folk-lore as the Wild Men and Fair Women of the Hills, unlike the Christian mortals of historic times, yet unquestionably men and women, with strange ways and morals, dwellers in dense forests and inaccessible mountain wildernesses? No one can tell. I cannot learn what part Velika Planina played in the centuries that followed the German conquest, when the



A hut on Velika Planina.

great Benedictine monastery of Obbreburg (Gornji Grad) was founded and the wealthy shrine of Neustift (Novi Stift). How timidly these settlements kept to the wide valley-way, crowded together by the vast forest slopes descending to their very doors to this day! If folk tales reflect the truth, there was cause enough to shut those doors at night, and keep within them, too, for all good Christian folk, lest the alien, unconverted world of the hill should find an entrance during the dark hours. I cannot even learn what part the settlements played in modern centuries, in the troublous times that followed the Thirty Years' War, when the forest region around Kamnik sheltered large and powerful communities of freebooters, who were often the virtual lords of this maze of Alpine foothills. The reign of the freebooters, overlapping that of the lawful Austrian authorities and of the temporary French Government under Napoleon, lasted well into the nineteenth century, an effectual barrier against tourist penetration of the Kamnik Alps, long after the Upper Sava Valley had already been "discovered" by Sir Humphry Davy and described by Gilbert and Churchill. They were a mixed lot, those freebooters, deserters from the army, criminals hiding from justice, broken men flying from ill-fortune, or men born out of time and at odds with the prevailing order of things. One of the huts on Velika Planina is owned by an old lady who still remembers Black Jurko, last of the Kamnik brigands. From her I gathered that Jurko sometimes haunted Velika Planina. Once he caught a lad whom he suspected of having betrayed him, and hanged him over an ant-heap, so that he perished miserably. This atrocious deed roused all the population of the hills, and he was caught and imprisoned in chains at Gradisca (then under Austria), in a dungeon over the Isonzo. He managed to escape, and died at Kamnik, a beggar, in 1865.

Colour-Psychology in Daily Life

By Dorothy M. Andrew

Growing appreciation of the value of colour in everyday concerns becomes daily more evident; but many opportunities are wasted. Skilful use of colour makes advertisements attractive, yet our streets remain for the most part drab. The author shows how far we are affected by colour-psychology, and how its beneficent influence might be extended.

THIS is not an attempt to consider the nature of light-sensation, colour-tone, colour-blindness, nor any of the more formal aspects of colour in relation to psychology. Colour in everyday life should serve for beauty and for delight. While it has also secondary uses these remain its chief ends.

"The old world glows with colours, dear,
And if, as saith the saint,
The world is but a painted show,
Oh, let us lick the paint."—G.K.C.

In England, we of the cities and towns, have been given all too little paint. Nature shows us her least colourful side, and those responsible for the appearance of our buildings do little by way of compensation. Professor C. M. Reilly, writing in the *Manchester Guardian* a short time ago, said of the Ancoats district of Manchester, "How decent, architecturally, are many of these little early 19th century streets, and how pleasant they could be made in appearance with a little bright paint . . . it is the dreary, unrelieved dirtiness of these soot-laden areas that kills the soul . . . with whitewash and bright colour, they could easily and quickly be made to look, instead, like posters inviting one to a holiday in Holland." Undoubtedly our lives could be much more enriched by colour than they are. Undoubtedly, too, we could do much more to help ourselves in the matter. For this reason some study of the psychology of colour in relation to everyday life should be helpful.

In his *Introduction to the Theory and Practice of Psychology*, Professor Wynn Jones tells us that colour-sensitivity can have many meanings. "It is sometimes taken to denote the capacity to see a minimal amount of a colour when mixed with black, white, grey or another colour . . . the artist mixing his colours or painting a picture, and the chemist examining his precipitates or producing dyes, would be expected to find such a capacity a great asset." It may also mean, "the capacity to distinguish between two shades of a particular colour." Here the Professor cites the example of employees in a velvet factory on the Rhine, who could arrange forty shades of black in their correct order. But by colour-sense in everyday life, "one understands the capacity to judge and evaluate colour-combinations aesthetically," and, as one would expect, there is a

great diversity of judgments, not only among nations, but among individuals, as is exemplified in the widely varied colour-schemes for dress and homes.

It is obvious, too, that individuals differ greatly, not only in their preferences for, but also in their sensitiveness to colour. Bullough's findings on type-reactions to colour are fairly well known. He reports that some individuals are most affected by one aspect of colour, some by another. He names four aspects—the objective, the physiological, the associative, the character. The objective reaction to colour is concerned with such aspects as its tone, its luminosity (e.g., a colour may be found pleasing because it is clear). The physiological aspect, as the name implies, is a preoccupation with the physiological effect of colour and is subjective, e.g., colours are described as soothing, exciting, cold. From the associative aspect, reaction is caused through a colour's being associated with things of the outer world, e.g., green is considered beautiful as the colour of fields and trees. The last reaction—that of character—might also be called the aesthetic aspect. It has been described as "a further development of the physiological and the associative," and consists (according to Professor June Downey, of Wyoming University), "in reading the subjective reaction back into the colour itself." From this aspect a colour is pleasing or displeasing, because it is, of itself, so to speak, truthful, aggressive, etc.

Emotional Value

All this is sufficient to illustrate the inevitable variations in colour-preferences among different people. At the same time experiments have shown that the emotional value for any given colour remains comparatively constant. So that Professor Downey is able to assert that, "Red is exciting and frank, the colour of warmth and of love, of luxury and of anarchy. Yellow is gay, suggestive of exuberance and of merriment; the sacred colour of the Orient, in the symbolism of the West it stands for jealousy. Blue is the colour of serenity. It symbolises constancy and reserve. It suggests depth, atmosphere, profundity"—and so on. Green is described as "soothing, a symbol of aspiration," while the feeling-values of purple and violet are "uncertain." Again, she says, "we can assert with confidence that red and yellow excite the organism and increase its

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muscular strength ; green and blue soothe and calm the nerves." The usefulness of such knowledge in the employment of colour in our everyday life—in our clothes, homes, schools, shops—is easily seen. In the light of such information one sympathises with the patients in a certain isolation hospital where sufferers from scarlet fever lie between red blankets in wards with red window-blinds.

It is interesting to compare these findings on colour in relation to psychology, with colour theories from the point of view of art. Of the latter theories the most elementary are as follows. Red, blue and yellow are the primary colours—the basis of all others. They have been aptly termed, "the eternal triangle of colour." Binary colours, that is to say, colours obtained by combining two of the above, are orange (yellow mixed with red), violet (red and blue), and green (yellow and blue). Eberlein, McCure and Holloway, in their book, *Interior Decoration*, state that "Yellow and red . . . in their pure state form no harmony, but rather a discord . . . yellow, orange and red are aggressive and warm colours, and green and blue are quiet and cool colours." The point it is desired to make is, that there is a remarkable agreement between psychological colour theories and purely artistic analysis of colour. Using our knowledge of both, it is clear that the hard and strong primary and binary colours would not be used in large masses by one of cultivated taste, but are useful rather as "accents" to the more agreeable subtle tones, such as rose, grey, or buff.

A Neutral Colour

Common sense demands that, in use, colour should be considered in relation to other factors, such as space. In general, however, it is useful to remember that yellow gives the effect of light ; all reds have the quality of warmth ; orange, being composed of red and yellow, combines the qualities of light and heat ; blue is retiring, cool, even cold, and "quietening in its influence" ; green, the combination of blue and yellow, combines the qualities of these two colours and is light, cool, and quiet ; violet has been described as neutral—it would seem that the conflicting qualities of red and blue, of which it is composed, neutralise each other. Discrimination in the use of colour implies the ability to achieve light and cheerfulness without sacrificing quietness—a matter of blending and wise combination.

One of the most recent developments in the use of colour in everyday life is in the field of advertising. Electric signs, posters, magazines, catalogues, all use the appeal of colour to enhance their commercial value. While some advertisements have real artistic value and make a subtle appeal to the aesthetic sense, it is to

be regretted that, in many, colour is so used that it commands attention without any appeal to the sense of beauty. The psychological effect of the latter class is satisfactory only to the advertiser. Devere Higginson (Professor of Psychology at the University of Illinois) has made a special study of the use of colour in advertising. He says, "It is generally recognised that the use of colour brings higher returns," and gives, as an example, the case of a firm which, for a shoe advertisement, used some bills with a black and white background and some with a coloured one. The price and quality of the article were identical on each bill ; but the coloured one brought in thirty times as many orders.

Associative Colour Appeal

It is interesting to note the increasing use in advertisements of words with an obvious "associative" colour-appeal. Our silk stockings are no longer described as brown, beige or grey, but more alluringly as sun-tan, sandalwood, mist—to mention only a few of the dozens of hues. Dresses are burgundy, pine-blue, lime. Our cosmetics include shades of powder answering to such descriptions as peach, ochre-rose, and apricot, and lip-sticks run the whole gamut of coral, ruby, raspberry, poppy and the rest. One can only assume that here again the colour-appeal is responsible for increased sales.

This theme of colour in everyday life has so many variations that it is almost inexhaustible. Words, for many people, have "colour-haloës" or "atmospheres". In some cases the words may cause a colour-feeling, others actually see the word coloured on paper as they read it. While association may account for certain word colours—e.g., "blood," seen as a red word, "jealousy" as green, in other cases there is no apparent association, as, for instance, when "courage" is seen as brown or "dance" as pink. Again, many present-day psychologists are occupied with experiments and discussions concerning the relation of colour and sound. One of them quotes the case of a girl who, when listening to a telephone message, sees the colour of the speaker's voice. Suggested explanations are numerous, but opinions seem to agree that when sounds arouse colours they do so on the imagined plane rather than on the sense-level, and that while coloured sensation is rare, coloured thinking is common.

Since the psychological effects of colour are so far-reaching and capable of such practical application they are worth our attention and study. The poetry of colour is all around us—in nature, in art, in literature ; a gift to be used and appreciated. When it is a question of "penny plain and twopence coloured" let us, like Robert Louis Stevenson, be prepared "to go the length of twopence every day of our lives."

Tom Paine

READERS of DISCOVERY must be interested in the rediscovery of one of the most vigorous, notorious, and influential Englishmen who ever lived and left his country to do his work abroad. For, though he was intensely English, England in his lifetime had less use for Tom Paine than the United States or France. Only now, two hundred years after his birth at Thetford, has a chorus of acclamation gone up for one who spent himself so disinterestedly for the causes in which he believed, and who, in so many cases, anticipated the verdict and the efforts of those who succeeded him.

The whole life is so full of exciting and instructive incident that every one should read it in Mr. Hesketh Pearson's lively volume.[†] But only the outstanding facts can be mentioned here. Paine never accepted gladly his father's occupation of a staymaker and, after a few years' troubled service as an exciseman, he left England for the United States with a letter of introduction from Benjamin Franklin. This was in 1774 and was the turning point in his career. The American colonies were beginning to chafe under the vexatious taxing system which our stupidity imposed upon them, and only needed a strong lead to determine to throw off their allegiance. There can be no question but that it was Tom Paine who gave it to them. He was always outspoken, uncompromising, and tenacious, and while Washington and the other American leaders were still playing with the idea of a reconciliation, Paine declared that they should strike for "freedom." His first famous pamphlet, "Common Sense," followed by a series called the "Crises," supplied fuel for the flames, while Washington kept his forces together in Valley Forge. Though all these writings sold in tens of thousands, Paine refused to make a penny profit, while sometimes unable even to pay for his own boots. Later on he received a small salary as a writer for the cause.

Escape from the Gallows

Between this first epoch in Tom Paine's life and the second, still more exciting, in France, one ought to notice the episode—which recurred again and again—of the model for a bridge. His ingenious mind was always conceiving ideas for machines or improvements, and this bridge, with an unusually wide arch, was exhibited in many places and, finally, adopted for a bridge over the Wear at Sunderland in 1796. Before that, however, the second greatest event in his life took place. He went to Europe, as a sort of unofficial envoy of the States to France, and remained in the Old World for fifteen years. These covered his election to the French Con-

vention in 1792, his share in the drafting of the new French Constitution, his bold and persistent effort to save the life of Louis XVI and the saving of his own life—by the strangest fluke—when he was under sentence of death from Robespierre. Did anyone else ever have such a varied, thrilling and eventful life?

Sympathy of Pitt

The last stage was the saddest, and one cannot think of the poor, embittered, brandy-sodden man without a pang. Yet his mind was vigorous to the end, and he had good reason for resentment against Washington, who had left him for nearly a year languishing in a Parisian gaol and only escaping the guillotine by the purest chance. That was not treatment which a man might have expected who, more than any other writer, had built up the United States of America. Both Paine's later and most famous books were written in France, the last and most attacked—the "Age of Reason"—being actually a diversion while he lay under the shadow of the guillotine. The "Rights of Man," which answered Burke's "Reflections on the French Revolution," was written in 1790. This was the most unanswerable thing he ever wrote. Pitt himself admitted his sympathy with it, and had Paine ended there—without his last wild and embittered stage—he would not have needed to wait so long for his rehabilitation. His fight for poor Louis XVI would have stood him in good stead. But the "Age of Reason" identified him with the Evil One, not only in England but in the still more orthodox United States. It is a crude and quite unhistorical criticism of the Bible, though much of it is now the commonplace both of exegesis and of moral and religious philosophy. Paine was no atheist, but his strongest contention, often repeated, was that the universe and not any book was the revelation of the Creator.

He returned in 1802 to the land of his adoption, which he had done so much to create. But the States were now no longer friendly. Not only had he offended their deeply-rooted Bible Christianity, but he had attacked them on their most vulnerable social and commercial institution. He was an outspoken and persistent abolitionist, and, though his staunch friend Jefferson was now in power, the friendship did more harm to Jefferson than good to Paine. "Let Jefferson and his blasphemous crony dangle from the same gallows." That was the tone of the last few years which came to an end in utter misery on the 8th of June, 1809.

There is no story of an Englishman which combines so much of public interest with brilliance, unworldliness, determination, dash and tragedy in the chief actor.

F. S. MARVIN.

[†] Tom Paine. (Hamish Hamilton).

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Roald Amundsen's Last Journey

By Hans W. Priwin.

"I retire now—others may go on. But if any man needs my help I shall be at his service," said Roald Amundsen after his flight over the North Pole, in an airship, in 1926. When two years later, the "Italia" crashed he went to assist Nobile. It was his last journey.

The world easily forgets—but has anyone forgotten Roald Amundsen and his last flight? Nine years ago, in June, 1928, he took off from Tromsö to hurry to the assistance of the unlucky *Italia* expedition—have we forgotten that? No—we remember those days tense with excitement, when the whole world hoped that the brave Norwegian would come back. Three years before, in 1925, he had disappeared but he had returned then. A veil of mystery has covered the disappearance of the Arctic hero Roald Amundsen; many rumours have been, and still are, current about events in those days of June 1928. Gunnar Hovdenak, a Norwegian, who took part in the expedition to find Amundsen, has published a book in which he gives full details of Amundsen's last flight and draws the veil of secrecy from this story of self-sacrifice and heroism.

On May 25th, at 10.30 a.m., the Italian airship *Italia* crashed near the Pole whilst flying on a southerly course. The ship had to battle against heavy head-wind which later developed into a storm. Snow fell constantly and caused ice to form on the ship's surface. The weight of the ice became so great that the stern of the ship sank down. Soon afterwards she struck an iceberg and crashed onto the ice. The bridge and one gondola were torn off. Lightened, she ascended again and was driven by the storm in an easterly direction, with six people still on board. Nine had been left on the ice—one being killed in the crash. These nine, among them General Nobile, the leader of the expedition, who was badly injured, saw the yellow hulk of their ship

disappear. It is reported that a thin cloud of smoke was seen shortly afterwards on the horizon—and from that time the *Italia* has never been seen again.

The nine men on the ice discovered that the radio transmitter installed on the bridge was intact, but it was a long time before they could establish contact with the *Città di Milano*, the Italian ship which had followed the *Italia* to the north. When radio reports from the *Italia* ceased on May 25th, the people of Norway became concerned about the ship's fate. Search-parties were hastily arranged and sent out from Norway, Italy, Sweden and Russia. The Norwegian Navy sent two experienced airmen, Riiser-Larsen and Lützow-Holm, who flew two small planes and used the arctic ship *Hobby* as carrier and base for their operations.

Lützow-Holm started his search on June 5th, and on June 10th Riiser-Larsen followed suit.

Meanwhile Nobile and his companions had tried to get in touch with the civilised world by means of wireless, and on June 3rd, their signals were heard for the first time at Archangel. The Russian Government forwarded the S.O.S. message to Italy, but it was not until June 9th, that the *Città di Milano* succeeded in establishing communication. The world learned that the accident had happened on an iceberg near the Isle of Moyn. The search parties now had more definite information to work on. On June 17th, Riiser-Larsen and Lützow-Holm flew over the iceflake without detecting the Nobile group, but three days later they were discovered by the Italian pilot Maddalena. Three days later still, seven



Roald Amundsen

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Swedish flyers were on their way to Moyn—two of them, Lundborg and Schyberg, were the first to land on the ice-flake.

On June 19th, two Norwegian flyers who took part in the rescue work received a telegram. It came from the Norwegian Government and asked the pilots to proceed immediately to Västsvabard and to search for *Latham 47*, a French flying-boat with Amundsen on board.

There was a disagreement between Nobile and Amundsen after their polar expedition with the airship *Norge*; but Amundsen forgot all this when he heard that Nobile was in distress. He tried to obtain funds for the purchase of a flying-boat, but he was not successful. On June 14th, after he had already given up hope, he received a long-distance call from Paris. The director of the Franco-Norwegian Chamber of Commerce, Herr Fredrik Peterson, was able to interest the French Navy in the rescue work. They agreed to put a flying-boat at Amundsen's disposal; the *Latham 47* was chosen. She was a two-engined biplane of French origin, the engines developing 500 h.p. each. The fuselage was made of wood and was 60 feet long. The canvas-covered wings had a length of approximately 80 feet.

The *Latham 47* was quickly overhauled and flown to Bergen, piloted by Capt. Guibaud. She arrived at Bergen on June 16th, the crew consisting of three men, and, in Bergen, Roald Amundsen and Lieutenant Leif Dietrichson were taken on board. Dietrichson had taken part in Amundsen's expedition in 1925 when they tried to reach the Pole in two flying-boats, but had been forced to turn back at 87° N. The plane went on her way and arrived at Tromsö at dawn on June 18th. After fuel had been taken on board and a last overhaul finished the expedition was ready to start. At 2 p.m. new weather reports arrived—the weather was splendid, no wind, no clouds, so the flyers had nothing to worry about. At about 3 p.m. the men went on board and the flying-boat was tugged out of the harbour of Tromsö, and then, at exactly 4 p.m., she took off.

An Unknown Route

Amundsen, as usual, did not discuss his plans, and nobody in Tromsö knew anything definite about them. But it is generally believed that his intention was to fly to the Kungsfjord at Svalbard, which is approximately half way between Franz-Joseph-Land and Greenland, and that he would start his search from this base. However, Major Maddalena, the Italian pilot, who started later than Amundsen from Tromsö, was the first to reach the Nobile group. It was really a race between the two planes, and the fact that Maddalena arrived at the Kungsfjord without having seen Amundsen was considered a proof that Amundsen was flying

in the direction of the Pole. The last time that wireless signals of the *Latham 47* were received at Tromsö was at about 7 p.m. The plane was said to have covered half the route to the Kungsfjord and to be at Björdnön. At 7.15 p.m. the *Latham 47* was called by wireless, but no answer was received so that it is likely that the accident must have occurred between 6.45 and 7.15 p.m.

At the start the expedition had good weather and as already stated, the prospects were equally good. However, the weather reports did not prove to be correct for the whole route. The plane took a southerly course and was seen flying high over the Ry Stream and later over the Malang Fjord near the Hekkingen Lighthouse. Amundsen was, therefore, cautious enough to choose the southern route instead of the more difficult northern route via Torsvåg. He did so apparently to avoid fog in the North. From Hekkingen the course was altered and the plane flew in a more northerly direction at a greater altitude. From the Malang Bank a bank of fog could be seen in the north and the course was altered again to north-west.

Fishermen near the Malang Bank said that they had seen the plane flying at a good speed taking a north-westerly course. The altitude was said to be 600 feet. While these observations were made, the plane went higher, and disappeared at about 2,700 feet in the fog. Amundsen's intention was probably to go through the fog assuming that the bank was only a small one. The same fishermen said that the *Latham* was about fifteen miles from the Norwegian coast and that a storm was brewing, so that it can be assumed that after having navigated in the dense fog the *Latham* was struck by the storm and crashed. In Norway and the rest of the world anxiety increased when no communication came from Amundsen. Search parties were arranged in which Riiser-Larsen and Lützow-Holm took part, together with many Swedish airmen; French, American, Russian and Norwegian boats went to the Arctic Sea.

But the search was in vain. Not before the end of August was the first clue to the *Latham*'s fate found. Near Torsvåg, north of Tromsö, a float was found which later proved to be the port float of the *Latham*. Another proof was found near Namsos, on October 13th, when fishermen discovered a petrol tank which on inspection proved to be the reserve supply of the *Latham*. From these facts it has been assumed that the accident must have occurred at about Lat. 72° N. and Long. 12° E. in the open sea north-north-west of Tromsö. The plane was apparently forced to descend in consequence of the heavy storm and fog and in spite of the desperate efforts of the crew to keep her floating the plane went down—with Roald Amundsen and all his comrades.

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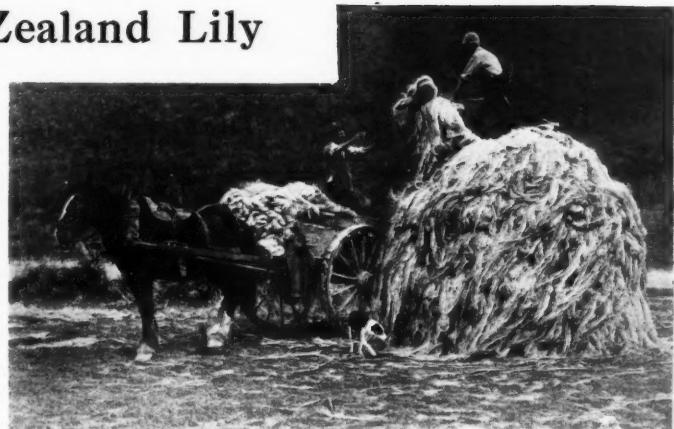
Flax from a New Zealand Lily

From a Special Correspondent.

New uses for the leaves of the giant "New Zealand Flax" plant.

SCIENCE has revealed the possibilities of producing, on a commercial basis, a wide variety of commodities, including fibre-silk, paper, varnish, and cellophane from New Zealand Flax (*Phormium tenax*), apart from the hemp for which this plant has been known for over a century.

New Zealand's giant lily, with its great sword-like leaves, crimson flower, and tall, upright stalk, was first noticed in 1770 by Captain James Cook, who, in his journal remarked on the many uses to which it was put by the Maoris. Sir Joseph Banks, the famous botanist who accompanied Cook, brought seeds to England. These were planted at Kew Gardens, where they flourished and attracted much attention. Cook's report on the variety of articles made from the flax fibre



"Flax" being loaded from the stack.

by the New Zealand natives—beautiful silk-like garments, cordage, fishing lines and nets—aroused interest in the discovery, and in the early days of the colony a considerable trade in New Zealand hemp was established. During the years 1828-32 more than £50,000 worth of the fibre was imported into England for the manufacture of rope and sacking.

But the crude methods of preparation then employed resulted in the production of an uneven fibre. The manufacturers had merely adopted a variation of the Maori method of decortication and bleaching, but had not copied the painstaking native craftsmanship which rid the flax of all unevenness and produced fibres ranging from fine white silky threads to strong tow-coloured material for cordage.

For a time, however, New Zealand hemp had precedence over that imported from Manila and elsewhere; but lack of care in preparation, and the disruption of trade during the Maori wars of 1863-8, ruined the flax industry, and British merchants ceased to purchase hemp from New Zealand. The trade revived to some extent when the Spanish-American War made the importation of Manila hemp difficult and costly; and meanwhile, important developments in the preparation of New Zealand flax fibre had taken place. Research and invention had enabled scutching machines to decorticate the leaves thoroughly and rid the fibre of all gummy residue, leading to still further prosperity in the export trade.

Latterly, the cheaper production of sisal hemp in the Far East and Africa resulted in another decline of New Zealand hemp imports into Britain. More recently, however, Dominion flax has come into demand for ropes for the British Navy, while the growing requirements for wool-packs for New Zealand's huge annual wool yield are now causing a revival in the industry.



The plant growing at Kaingaroa, North Island. Both pictures by permission of the High Commissioner for New Zealand.

Science has now discovered that the giant lily can be turned to account for many other products. Research by a young Australian scientist, Dr. H. Brown, at Auckland University College has shown that New Zealand flax has a very high cellulose content—second only to that of cotton—a discovery that has led to the production of a fine silk fibre which takes dye well and has actually been made into fashionable garments, though the production has not yet reached the commercial stage. The process involves cutting the long flax leaves into short lengths, which are cooked in a digester to rid them of fibre. The resulting viscous substance is bleached by exposure to oxygen, and the gum is eliminated by an alkali bath. The refined cellulose, which is now a liquid of the colour and consistency of honey, is fed from the container through a spray, and, on exposure to the air, hardens to a strong, silken thread. This thread is wound on reels and later dyed ready for weaving.

Some of the liquid cellulose is allowed to run over a

specially prepared surface and in a minute or so is converted into transparent sheets of "clarofoil" (as this particular product is named). This too, can be dyed various colours, and used for wrapping trade products. The particular value of clarofoil, however, is that it excludes the ultra-violet rays, which cause deterioration in the flavour of many foods. It should, therefore, prove invaluable to industries concerned with the export and sale of foodstuffs, as it guarantees against loss of flavour due to lengthy transport and storage. New Zealand flax cellulose can likewise be made into paper—both for newsprint and wrapping purposes—while other by-products include power alcohol and a clear, white, millinery varnish.

It is a far cry from the hand-woven fibre garments of a primitive Polynesian society to the fashionable, artificial silk wear demanded by modern European woman. But science, in its ceaseless search for means to supply the ever-increasing demands of the times, has once more made invention serve necessity.

The Friends of Progress

(Continued from page 210)

A good many of the exhibits consisted of inventions which were subsidised or rewarded by the Society. Among these may be mentioned Robert Lawrie's method of colour printing, 1776, the specimen shown being a print of the Australian Poa bird, which once belonged to Captain Cook; Popham's semaphore, by which a message could be sent down from the Admiralty to Portsmouth and confirmation received in 15 seconds; the first practical lifeboat, for which Greathead received a gold medal and 50 guineas in 1802; and a model of the first electro-magnet, the credit for which is due, not to Faraday, but to Sturgeon, who demonstrated his invention before the Society in 1825 and was awarded a silver medal and 15 guineas.

Among the Society's activities in the 19th century its origination of the Great Exhibition of 1851 was prominent, and among other interesting objects connected with the exhibition were the Minutes of a meeting of the Council of the Society with the Prince Consort (its President) at Buckingham Palace in 1849, with numerous corrections in the Prince Consort's own handwriting. A group of exhibits proved the Society's claim to the parentage of three important institutions, although a similar claim could be made in connection with a number of others. It was the Society of Arts which, in December, 1852, held the first public exhibition of

formation, at the Society's house, of the Royal Photophotographs, and this was followed next month by the graphic Society. The other institutions whose connection with the Society were shown are the Royal College of Music, a successor to the National Training School for Music, which was founded by the Society in 1876, and the School of Wood Carving.

A Convivial Note

The lighter side of the Society's work was not omitted. Among some amusing records shown was the account of the laying of the foundation stone of the Society's house in 1772, after which, it is stated, the company "proceeded to dine at the Adelphi Tavern, where the remainder of the day was spent with that harmony and good humour which a consciousness of promoting the good of mankind and of society will never fail to inspire." Another notice, dated 1869, said, "The vulgar habit, common throughout Europe, of mobbing distinguished persons on their visits to public places, needs reform; and the Society of Arts may well attempt to introduce it. The Council of the Society appeals with confidence to the members to assist in preventing the mobbing and following any royal and distinguished persons who may attend the Conversazione of the Society on the 1st of July, and requests them to assist in enabling such visitors to enjoy the privilege of walking about unmolested, and seeing the objects of art, like any private person."

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Book Reviews

The Moron's Progress.

The Fight for our National Intelligence. By R. B. CATTELL. (King. 8s. 6d.)

Of the two great problems facing this and other countries at the present time, that of the declining population has been well ventilated over the wireless and in newspapers and has received authoritative treatment by Enid Charles and D. V. Glass (see DISCOVERY, Sept., 1936, pp. 276, 300). The other major problem is that of our declining intelligence, which the author here treats as authoritatively as he could, working single-handed. The subject is of such importance that it receives three prefaces, by Lord Horder, Major Darwin, and F. P. Armitage. To quote the first of these eminent men, "The gist of Dr. Cattell's discovery is this, that the birth rate is falling much more rapidly amongst those social classes in which intelligence is relatively high than it is in those in which it is relatively low. The level of the nation's intelligence is, therefore, steadily falling. So much so that if matters continue as they are now going on, our author reckons that in 300 years from now half the population will be mentally defective." This, like Enid Charles's calculation of population diminishing to a vanishing point in the same period, is not a prophecy, but a calculation which measures existing states in a somewhat dramatic form.

Any number of factors may and, indeed, must enter, if it is desired that our civilisation, the like of which the world has never seen, shall not fade out in the immediate future. The author suggests, without being dogmatic, that the rise of a population to prosperity, followed by a marked differential fertility with a consequent decline in intelligence towards inevitable disaster, is a common feature of civilisations in the past and may be escapable only if we are thoughtful enough to crush our timidities and boldly apply the measures that modern science indicates, drastic though they be.

The Intelligence Quotient

The author indicates the generally accepted method of measuring intelligence by the I.Q. (intelligence quotient), the ratio of mental age to actual age, expressed as a percentage. To quote a few figures, secondary school and university teachers have the highest average of 151 (139-153), shorthand-typists 129 (114-141), shop-assistants 99 (90-124), factory packers and sorters 78 (56-92), the ranges and averages being taken for small groups of a score or so. The author

applies the technique of measurement, which excludes formal knowledge and depends only on innate capacity, to children aged ten, from two groups of families, one in the rural Dartmoor area, the other in the industrial town of Leicester, the total numbers being 861 and 2,873 respectively. The distribution curves with respect to I.Q. are then worked out, with the result that the urban and rural children average 100.8 and 93.4 now, and will decline to 98.1 and 90.6 in the next generation, taking account of the fact that the families which now contain high values of I.Q. are less fertile than those which contain low I.Q.'s. While the author admits the defect of numbers tested, he defends the sample on general grounds and deduces at very great length the various implications inherent in a nation declining in intelligence: the increasing degradation of work and leisure, the tendency for dictators to rise and destroy what democracy we have, and the increasing impotence of those with superior brains.

Suggested Remedies

The author suggests remedies in the last and longest chapter. The false sets of values of the middle classes, with enhanced costs of education, must obviously go, together with all class distinctions which lead to class suicides. The sub-cultural social defective must be recognised as such and dealt with, and the able child made an economic asset. Family allowances, of amounts which really represent the incremental cost of rearing children, should be provided differentially to those parents of high-grade stock. Universal dissemination of information respecting birth control would certainly be useful eugenically in reducing the economic pressure on the more intelligent sections of the community. Then there is the possibility of applying Christian principles of morality, which are hardly recognised to-day, officially or otherwise. More dramatic is the eutelegensis proposal, the impregnation of willing women, married or otherwise, from high-grade stock. The universal discouragement of sexual development in the adolescent is also condemned as dysgenic, as it tends to place false valuations on social ends, which must be subject to further de-education in the adult before the desirability of rearing a family becomes paramount. The author is devastating in his psycho-analysis of the present social melancholia and waxes lyrical on the potentialities of reform. All that is now asked is that everyone, man, woman, and child, shall understand the problem and choose an appropriate solution.

L. E. C. HUGHES.

A Cheerful Adventurer

Hunting Beasts and Men. By P. H. COMBE. (Robert Hale, 12s. 6d.)

The title and jacket of this book are somewhat unfortunate, as they give the impression that it is another of those monotonous descriptions of killing large animals for trophies. True, there is a fair amount of shooting, but for a living. The author went to Africa as a callow youngster, but found his feet soon enough, and now gives us an account of his adventures which have a certain charm of unsophistication. But to the serious reader its naiveté is rather irritating. He does not know a termite from an ant. He shoots a mountain zebra somewhere in Rhodesia, without realising that the skin would have scientific interest. Elands' horns can hardly be described as long. He describes an antique knife from a Rhodesian ruin as "an unmistakably short bronze sword of a Roman legionary," of which he was sure because he has "seen swords like it in various museums." He found also a piece of tessellated pavement. Let us hope that both found their way into the Rhodesian Museum in Bulawayo. He was an extremely lucky young man, as on a visit to Zimbabwe he found a golden scarab. This he sold to a jeweller in Cape Town for £25, so we may hope it is by now adequately recorded. Some of his descriptions are not very convincing. For instance, after being robbed of everything except 4s. 6d. on a diamond prospecting expedition into what appears to have been the rain forest in the Congo a hundred or so miles towards the north west of Elisabethville, he does not make for the nearest inhabited place where he could get food, but makes his laborious way southwards, snaring game for food, travelling for some months, apparently a distance of about 600 miles, arriving eventually "as strong as iron" at "a dorp near Umtali." Not so very near, however, as it took him eight days at an average trek of 25 miles a day to reach Umtali. But one should not be too critical. The author has an attractive personality and a sense of humour. Adventures come to the adventurous, and he bids good-bye with the hint of another wild expedition in a different part of the world.

MALCOLM BURR.

Half Castes—Without Prejudice

Half Caste. By CEDRIC DOVER. (Secker and Warburg, 10s. 6d.)

Cedric Dover, himself a half caste, and likewise a skilled biologist, has written a courageous, interesting, and necessary book on a subject which has rarely, if ever, been examined without prejudice (to put it mildly). Professor Lancelot Hogben's foreword on "Prejudice" is therefore most apposite and, in these days when certain professors, speaking *ex cathedra*, have actually enunciated the principle that Science ought to be governed by Prejudice, is a wholesome corrective to some of the twaddle that is forced down readers' throats.

As the outcome of wide and comprehensive reading on every aspect of his subject, Mr. Dover has been able to sift his material thoroughly, and the result of his work is illuminating. One side of the problem of mixed "races" that has received inadequate attention hitherto is the psychological side, and this Mr. Dover examines thoroughly, though, as he justly says, "racial psychology is, at its best, an extremely contentious subject." However, even the most virulently prejudiced will find it difficult to give the lie to the statement of Bernalot Moens that "it is possible to obtain a better result when the mixture—of physical and mental qualities—is produced by the better types of the different races."

The chapter on "Biology and Bumbledom" is as amusing as

it is instructive. Material interests have divided man into territorial groups, and Mr. Dover notes that the major task of social biology to-day is to educate public opinion to appreciate the objections to such a division. Modern conditions are everywhere disturbing the environment complex, and territorial segregation is becoming more and more artificial. Ethnic persecution, especially in America, has attained, and maintains, a high standard of efficiency. Mr. Dover cites some remarkably ghastly instances from both past and present; but how far the racial jealousy behind them is mainly sexual, as he claims, and not economic, is a point that might be further investigated.

The "Aryan Theory" and its exponents not unnaturally provide the author with some of his most telling ammunition. Ploetz, Guenther, and especially Gauch, are quoted effectively regarding the characteristics of non-Nordic man, and Lothrop Stoddard provides some fine flowers of contradiction. Curiously enough, however, the "nigger" is much more likely to be treated with contempt by the half-educated in England than among the politically-organised racialists of Germany. The later chapters, equally interesting if less controversial, deal mainly with the historical aspect of various groups of half castes throughout the world; and a brilliant essay concludes with an estimate of the potentialities of mixed races now and in the future. Readers may disagree with some or all of the author's conclusions, but he thoroughly deserves their gratitude for a largely dispassionate discussion of one of the human world's major problems, that few sociologists have had the courage to tackle fairly.

The Chemistry of Life

The Metabolism of Living Tissues. By ERIC HOLMES. (Cambridge University Press, 7s. 6d.)

Dr. Holmes is not one of your glib-tongued popularisers whose books read like advertisements for glandular extracts. But, whereas the popular method of continual stimulation ends by dulling the faculties, a sober statement of new glimpses of truth is unfailingly exciting. To quote Dr. Holmes: "Well within living memory, the following argument was heard. ' You cannot apply chemical methods to cells until you have killed them; it is ridiculous to pretend that you can investigate the chemistry of life.' That no one would nowadays be taken seriously if he advanced such an argument is a tribute to the speed with which biochemical technique has progressed"—and, with it, our knowledge of vital processes. These advances are partly due to improvements in the two old methods—the study of the dead cells referred to, but killed with great rapidity during some particular period of metabolism; and the study of the food and excreta of a whole animal. But, supplementing these, we have new micro-manometric techniques which can be applied directly to small-celled animals or plants in life, or to surviving fragments of larger animals—in either case, direct to the cell.

We are told next of the results of this work—the details of cell oxidation, by which the energy of life is obtained; then on to the special chemistries of liver, kidney, muscle and nervous tissue in relation to their functions. Finally, there are chapters on hormones, salts and vitamins.

This book is neither elementary, in the sense that "any reader without any previous knowledge can read with full understanding," nor does it try to be exhaustive. Its virtue lies in its accuracy, its wide range, its biological outlook (biochemistry is no longer a hobby of enterprising organic chemists), and its brevity. It is intended primarily for students starting biochemistry; anyone with a little chemical and physiological knowledge would enjoy it; to many, whose work lies in a

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biological field, a short statement of the modern position will be invaluable.

Any criticisms can be explained (not excused) on the grounds of brevity. I felt that "the oxygen uptake *in vitro* of the uterus of an immature mouse is about doubled by treatment with anterior pituitary sex hormone" was ambiguous, leading one to the error of imagining a direct action of the pituitary on the uterus. Surely, too, we need some qualification of the scheme on page 196 showing the effects of various ions on excitability, or we shall imagine that the effects of sodium and potassium ions are equivalent and that they are mutually replaceable.

J. R. SQUIRE.

An African's Africa

The Soul of Nigeria. By ISAAC O. DELANO. (Werner Laurie, 10s. 6d.)

Books by educated Africans are always interesting and instructive. This one, by the son of an old Yoruba judge, is no exception. It is well expressed and, if somewhat naive, transparently honest. The author is an amateur folklorist, who travelled widely in his own country, collecting vanishing traditions, customs and tales from the old people. He laments the decay of manners and the destruction of the old civilisation of his people, with its high ideals. The one we have to offer he regards rather as an inevitable evil and a not quite successful substitute. "Frankly, a civilisation that has failed to put bread into our mouths is not worth much." He is critical, but not unfairly, of our methods, and credits us with good intentions, which is more than many of his people do, though they realise that they cannot stand alone, and would rather be under the British than any other power. The author is thankful that a more sensible method of education has now replaced the memorising-cum-flogging system of only a few years ago. "A civilisation that ties our hands, prevents us doing manual labour, and simply places a pencil behind our ears is useless."

The book contains several interesting stories. He tells us of a successful though unqualified surgeon, who knew neither antiseptics nor anaesthetics but operated with a hot knife, and had a profitable practice, in a land where doctors are paid by results. The most interesting chapters, perhaps, are those dealing with drumming and with Yoruba music, songs, and dances. The Yoruba belief in the power of running water to restrict magic occurs also in the Danubian vampire superstition, and is probably widely distributed. The Yoruba have only the vaguest tradition of their own past.

MALCOLM BURR.

The Anatomy of Discord

When Temperaments Clash. By MUNRO MACKENZIE, M.D., M.R.C.P. (Murby. 7s. 6d.)

The title expresses the subject of this book; Dr. Munro Mackenzie's aim is to describe in concrete language how "the components of human temperament" determine action in practical life. He begins by explaining the bearing of the nervous system on mental and physical health, and he shows how neuronic instability sets up the "anxiety apathy cycle," which is disastrous to happiness and success. This is "a disorder only known to the human, and caused through conflict between different kinds of people who consciously strive and innately refuse to adapt themselves in a world which, with few exceptions, makes on

allowance for the four different outlooks: those of the immediate and of the deliberate, who are again divided into those who express a craft and those whose concern is with the products of a craft."

Dr. Mackenzie explains that it is psychological discord within which makes the child an anxiety to his parents, the wife impossible in the home, and the kind business man dissatisfied with the secretary whose work is above reproach. And "neuronic instability is increasing as technical knowledge increases, because the latter only deals with environment and not with inter-human contact." He then examines four varieties of men, the craftsman, the advertiser, the dealer, and the administrator, and he shows how temperamental forces express themselves in tyranny and defence until temperamental clashing yields to temperamental release.

The book is clearly intended for the layman rather than for the scientist, and the author has aimed at the vivid and the concrete rather than the meticulously accurate. He does not, for example, explain how the different types which he describes are blended to some extent in every normal human being. The style, too, is sometimes over-rhetorical. But the book has the merit of dealing with a difficult subject in a very readable way; it is valuable for what it says, and still more valuable for what it suggests.

J. H. BLAKSLEY.

[NOTE.—The name of the publisher of the above volume was incorrectly given in a reference in the June issue of DISCOVERY. It is correctly stated here.]

The Frustration of Science

Sugar in the Air. By E. C. LARGE. (Cape. 7s. 6d.)

Mr. Large has provided—for what should be a wide circle of readers—that very welcome and too unusual product, a novel about normal working people. His chief characters are not enabled, by the possession of a comfortable private income, to defy the unities of time and place; nor are they tied down to the pseudo-romantic sordidness of the gutter. They live.

The main theme in any novel concerning Science to-day must almost inevitably be a tragic one of frustration and misdirection; a rule to which *Sugar in the Air* provides no exception. Pry, the confirmed worker in the cause of scientific advancement, sees a new and valuable process frittered away, thanks to the incompetence of a Board of Directors seeking only self-aggrandisement, and the malice of employees afflicted with jealousy; and his work is ultimately absorbed, with ruthless calm, into the efficient maw of an all-embracing combine.

The struggle of the hero to preserve and develop the process of extracting sugar from the air provides material for much entertaining incident and some good character-drawing. The vignette of Dr. O'Sullivan, the Irish Government scientist, is a brilliant study of the present-day Irishman; and the lady biologist, human despite herself, is another clearly-seen modern type. The book is essentially modern, and will perhaps displease those who refuse to recognise facts as they are. But the descriptions of the gradual development of the process, the discoveries, some intentional, some all but accidental, that arise out of the research work, and the team-spirit embracing the scientific workers involved—contrasted with the timorous indecision of the commercial parties concerned—make enthralling reading.

Mr. Pry is certain to get another job; may it be in as interesting circumstances as his last one.

JOHN LAMB.

Battlefield of the Gods. By PAL KELEMEN. (Allen & Unwin. 10s. 6d.)

There are not yet enough books upon pre-Columbian civilisation, and Mr. Kelemen's book would be welcome were it only of indifferent quality. It is, however, an unusually interesting presentation of the subject, disappointing perhaps for the thorough-going archaeologist, but admirably suited to the student of sociology who likes to see inanimate objects against a background of the life of the times. Unlike most writers on Mayan ruins, Mr. Kelemen finds himself easily able to leave the subject of the buildings themselves for the less impressive subject of the people who inhabited them, and the historical notes on the various groups of ruins are knit together with the narrative of the author's journey, which takes him at times out of the *milieu* of the classic Mayan architecture and into the Churrigueresque (and, incidentally, into one or two trifling errors, e.g., Borromenisco for Borrominesco). The style of the book has a genuine enthusiasm; one feels at times that the author's thoughts are too bright to express. He writes, for instance: "From the letters of Cortez a self-portrait takes shape worthy of the brush of a Spanish master: an elastic figure with a hard expression, wearing a small pointed beard, surrounded by mediæval atmosphere"—scarcely a portrait to identify Cortez from a crowd of sixteenth-century Spanish gentlemen. However, sixty-one excellent plates atone for any "gaucheness" of the style.

Evolution out of Doors. By HENRY J. C. MOLONY; edited by J. R. DE LA H. MARETT. (Hutchinson. 15s.)

The best part of this book is the publishers' blurb: "The lure of the microscope has intensified the division between the outdoor man of action and the indoor man of thought. The one, after his tiring day in the glaring sunlight, has been content to doze in a mess-room bristling with antlers. As for the other, in his capacity as museum keeper and legatee of other men's collections, he has tended to limit his blood-sports to the warding off of the attacks of moths—Major Molony's work can help to break down this barrier. It will appeal to the scientific public . . . , and also . . . both to the junior subaltern fingering his virgin rifle, and the seasonal sportsman . . ." Gad . . .

And we find that Lord Babblebrook is right, these chattering scientists on evolutionary methods must be shown that they're not the only ones who can chatter. Sexual selection—dash it—how could it work? The ladies have too much of an eye for the economic side of marriage and, anyway, they're fickle. No, we can leave that to such dago birds as the ruffs. Scientifically worthless, the book may well interest many who know, or want to know, Indian animals. For your fifteen shillings you get some good photographs by John and Cherry Kearton and a gratuitous appendix by the Editor.

Science Front, 1936. By GERALD HEARD. (Cassell. 5s.)

The author is well known for his interpretations of science for the general reader, but does not altogether escape the danger of speculations on scientific results, which may not be justifiable on the basis of ascertained fact, but can be made entertaining nevertheless. The thing he does establish in this form of journalism is to make scientific results important to individuals and to social ends; he does not leave them as scientific curiosities to be enjoyed by the elect. There is much to report on the science front of 1936 and, without mentioning details, one might indicate

the arrangement as follows: Plenty (food, clothing, building), Health (diet, etc.), Prevention (family control, etc.), Pure Knowledge of Nature, New Finders (of knowledge), the Science of Ourselves (evolution and civilisation). The author deals with many things, from star cameras to bottled babies, and should give the thinker much to think about.

Ions in Solution. By R. W. GURNEY. (Cambridge University Press. 10s. 6d.)

In this interesting monograph Dr. Gurney applies to ionic phenomena in solutions the ideas concerning electronic energy and electron levels in atoms *in vacuo* which have been so fruitful in dealing with the structure of the atoms. The earlier chapters contain a very lucid and helpful analysis of ionic processes in atoms and molecules. Of particular interest are those sections dealing with the formation of electric double layers and the stability of assemblies of ions. The later chapters deal with the application of these ideas to some selected topics, including reversible cells, heat of dissociation and recombination, solvation energy, etc. Energy level diagrams are used freely to illustrate the text and are particularly helpful in enabling the reader to follow the argument. The book is a valuable addition to the literature of this border-line subject between Physics and Chemistry.

Books Received

- Insects of the British Woodlands.* By R. N. CHRYSSTAL. (Warne, 7s. 6d.)
Molecular Beams. By RONALD FRAZER. (Methuen, 2s. 6d.)
The Growing Child and Its Problems. By CAREL BIRKBY. (Muller, 12s. 6d.)
Pavlov and His School. By Y. P. FROLOV. (Kegan Paul, 12s. 6d.)
The Romance of The Alphabet. By A. B. ALLEN. (Warne, 3s. 6d.)
The Teaching of Art. By A. B. ALLEN. (Warne, 4s. 6d.)
Colour Harmony, Its Theory and Practice. By A. B. ALLEN. (Warne, 3s. 6d.)
The Lost City. By RENÉ DE JOUGNÉ. (Robert Hale, 12s. 6d.)
The Torch-Bearers. By ALFRED NOYES. (Sheed & Ward, 7s. 6d.)
The Soul of the White Ant. By EUGENE N. MARAIS. (Methuen, 7s. 6d.)
Anthropology. By A. A. GOLDENWEISER. (Harrap, 18s.)
In the Realm of Mind. By CHARLES S. MYERS. (Cambridge University Press, 7s. 6d.)
The Tongues of Men. By J. R. FIRTH; and *Noise.* By A. H. DAVIS. (Watts's Changing World Library, 2s. 6d. each.)
Archive Administration. By HILARY JENKINSON. (Lund, Humphries, 12s. 6d.)
Biology in the School. By H. ALAN PEACOCK. (Heinemann, 10s. 6d.)
Chemistry of Familiar Things. By S. S. SADTLER. (7th Ed.; Lippincott 15s.)
Chemistry, Matter and Life. By STEPHEN and L. M. MIAULL. (Arnold, 7s. 6d.)
Ecology in Town and Classroom. By R. BRACHER. (Arrowsmith, 2s. 6d.)
Grass Drying. By E. J. ROBERTS. (H.M. Stationery Office, 2s. 6d.)
Floral Morphology, Vol. I. By E. R. SAUNDERS. (Heffer, 3s. 6d.)
Botany (Catechism Series, Fourth Edition). (E. & S. Livingstone, Edinburgh, 1s. 6d.)
Mind and Memory Training. By PROFESSOR E. WOOD. (Pitman, 5s.)
In Search of Science. By HERBERT MCKAY. Three books, 1s. 10d.; *Progress and Conquest.* By S. RIVERS-SMITH and W. K. SPENCER. Two books, 2s.; and *The Life of the Honey-Bee.* From TICKNER-EDWARDES. 6d. (Simple Science Series, Oxford University Press.)

—July, 1937

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